



PORTLAND HARBOR RI/FS

**ROUND 3 LAMPREY (*LAMPETRA* SP.)  
PHASE 1 TOXICITY TESTING REPORT**

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April 6, 2007

**Prepared for:**

The Lower Willamette Group

**Prepared by:**

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## **LIST OF ACRONYMS**

<b>ASTM</b>	American Society for Testing and Materials
<b>C</b>	centigrade
<b>CaCO<sub>3</sub></b>	calcium carbonate
<b>CAS</b>	Columbia Analytical Services, Inc.
<b>EPA</b>	US Environmental Protection Agency
<b>FSP</b>	field sampling plan
<b>Integral</b>	Integral Consulting, Inc.
<b>LC<sub>50</sub></b>	concentration that is lethal to 50% of an exposed population
<b>LWG</b>	Lower Willamette Group
<b>LWR</b>	Lower Willamette River
<b>NAS</b>	Northwestern Aquatic Sciences
<b>pps</b>	pulses per second
<b>QAPP</b>	quality assurance project plan
<b>RM</b>	river mile
<b>SD</b>	standard deviation
<b>TRV</b>	toxicity reference value
<b>USGS</b>	US Geological Survey
<b>Windward</b>	Windward Environmental LLC

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## 1.0 INTRODUCTION

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Lamprey ammocoetes are the only detritivorous fish present in the Lower Willamette River (LWR). Four species of lamprey may exist in the LWR, and of these, the Pacific lamprey (*Lampetra tridentate*) was selected as the representative species for detritivorous fish (Integral et al. 2004). In the *Portland Harbor Remedial Investigation/Feasibility Study Programmatic Work Plan* (Integral et al. 2004), a tissue-residue approach was proposed to assess risks to lamprey ammocoetes. Tissue residues were to be compared to toxicity reference values (TRVs) from the scientific literature. The suitability of using TRVs for surrogate species to assess risks to lamprey ammocoetes was later questioned by the US Environmental Protection Agency (EPA) and its partners during the Round 3 data gaps analysis, and they requested acute toxicity testing to compare lamprey ammocoetes sensitivity against published toxicity data for the most sensitive surrogate species (EPA 2006).

The first phase of the acute toxicity testing was conducted in the fall of 2006; the second phase is planned for the spring/summer of 2007. This data report describes the objectives, methods, and procedures used during the Phase 1 toxicity testing with lamprey ammocoetes (*Lampetra* sp.) and the results of the testing.

### 1.1 OBJECTIVES OF TOXICITY TESTING

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The specific objectives of the Phase 1 lamprey ammocoete collection and testing effort were to:

- Establish proper methods for the collection of lamprey ammocoetes, including holding in the field and transport to the laboratory
- Establish proper methods for holding the ammocoetes in the laboratory, including feeding and temperature regimens
- Establish the proper exposure system, including size of exposure chambers, rate of flow through, and feeding requirements
- Perform range-finding toxicity tests with the following six chemicals: copper, aniline, pentachlorophenol, naphthalene, diazinon, and lindane

As stated in the objectives, the primary goal of the Phase 1 sampling and testing effort was to ensure that ammocoetes could be collected and transported to the laboratory in good condition and that the ammocoetes could be successfully maintained and tested under laboratory conditions. A proper exposure system was developed for the static renewal testing; the development of the flow-through system was proposed for the Phase 2 testing. Range-finding tests were conducted with copper, aniline, pentachlorophenol,

diazinon, and lindane. Because of the high volatility of naphthalene, the range-finding test with naphthalene was delayed until Phase 2 when it will be conducted as a flow-through test.

## **1.2 REPORT ORGANIZATION**

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The remaining sections of this document describe the field sampling procedures, laboratory holding methods, and toxicity tests of the lamprey ammocoetes. Section 2.0 presents the sampling procedures, and Section 3.0 describes laboratory methods. The toxicity test and temperature test results are presented in Section 4.0; cited references are listed in Section 5.0. Supporting information, including field collection logbooks and chain-of-custody forms are provided in Appendix A. The toxicity testing report from Northwestern Aquatic Sciences (NAS), including all raw laboratory data, is presented in Appendix B. The validation report for the toxicity testing is presented in Appendix C, and the validation report for the water chemistry is presented in Appendix D. Photo documentation of the field collection, holding facility, and toxicity testing is presented in Appendix E.



## 2.0 FIELD METHODS

This section described the methods used to collected lamprey ammocoetes in the field, including water quality parameters measured in the Siletz River.

### 2.1 AMMOCOETE COLLECTION

Lamprey ammocoetes were collected from the main stem of the Siletz River near the Cedar Creek confluence near Newport, Oregon, on October 17 and 18 and October 23 and 24, 2006 (Figure 2-1). The sampling location was selected upon consultation with Stan Van de Wetering of the Siletz Tribe and was reached on foot. The permitted maximum number of 800 lamprey ammocoetes was collected from an area covering approximately 125 ft<sup>2</sup>. The water temperature was measured daily before the sampling effort was initiated. The substrate was mostly medium to fine sands with a silty surface layer and some leaf litter. The sampling water depths ranged from 4 to 6 in. up to approximately 2 ft. The sampling dates, daily estimated catch of ammocoetes, and water quality parameters are presented in Table 2-1.

Table 2-1. Lamprey ammocoetes collection information

Collection Date	Estimated No. of Ammocoetes	Field Temperature (° C)	Laboratory Temperature (° C) <sup>a</sup>	Hardness (mg/L as CaCO <sub>3</sub> )	Alkalinity (mg/L as CaCO <sub>3</sub> )	pH (unitless)	Dissolved Oxygen (mg/L)	Conductivity (µmhos/cm)
10/17/2006	58	12.9	13.6	26	20	5.3	8.2	62
10/18/2006	250	12.6	12.4	26	20	6.0	9.6	95
10/23/2006	200	12.1	11.5	26	20	6.8	8.4	75
10/24/2006	300	11.8	10.6	51	90	6.0	8.8	150

<sup>a</sup> Measured in the coolers at delivery.

CaCO<sub>3</sub> – calcium carbonate

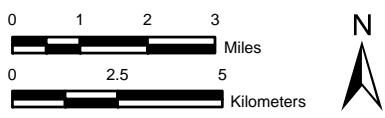
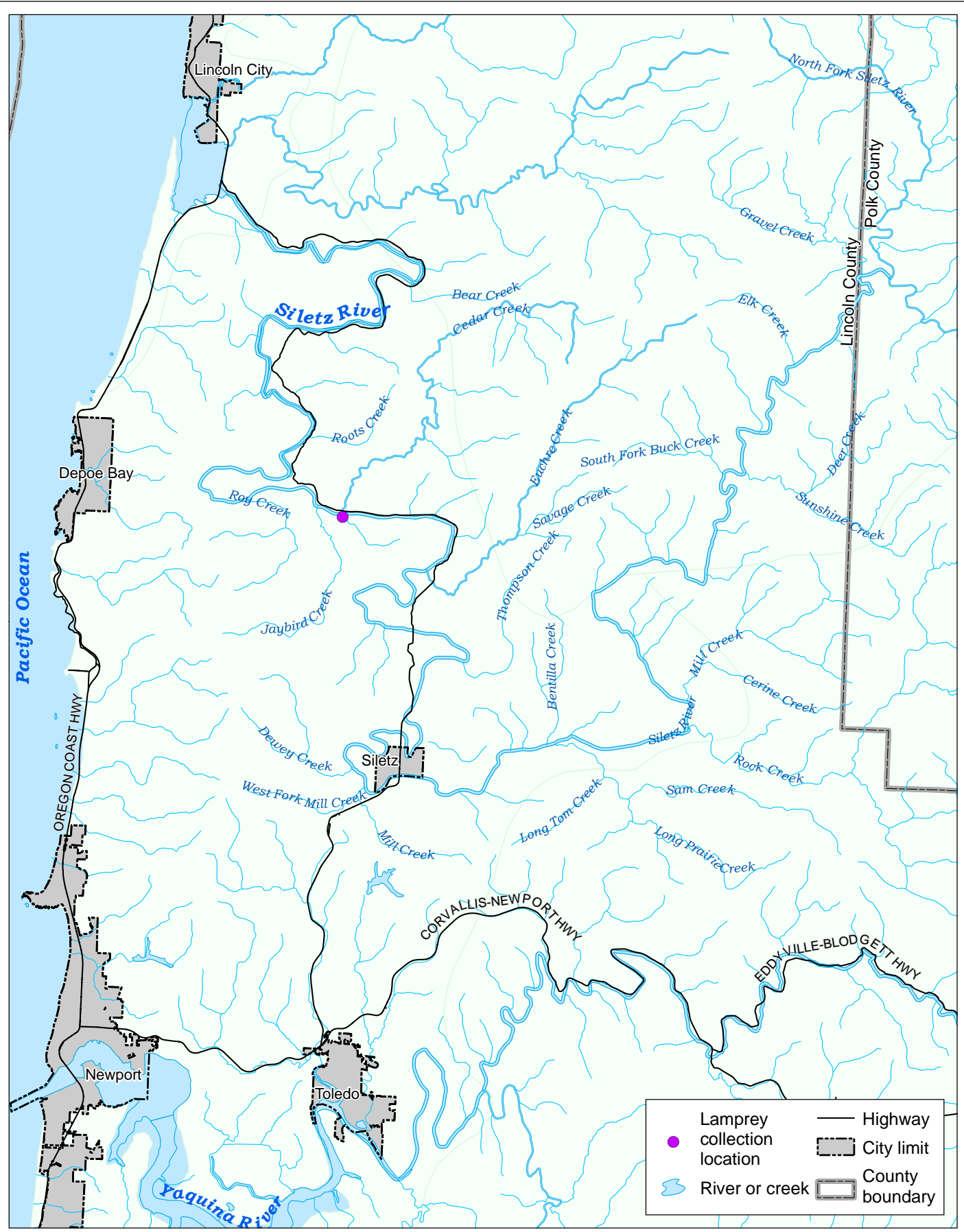
A Smith-Root, Inc., LR-24 dual-train backpack electroshocker was used during the collection. An initial setting of 3 pulses per second (pps) and 25% duty cycle was selected to withdraw the ammocoetes from the sediment, and a second setting of 30 pps and 25% duty cycle was applied to stun and capture the ammocoetes. Captured ammocoetes were placed in a pre-cleaned cooler partially filled with site water and approximately 6 in. of site sediment. Fifty ammocoetes were placed in each cooler. Frozen gel packs were affixed to the inside lids of the coolers to keep the water temperature cool during holding and transport to the laboratory. At the end of the sampling day, the coolers were then filled with additional site water before being transported to NAS in Newport, Oregon. Photos of the sampling effort are presented in Appendix E.

## **2.2 DEVIATIONS FROM THE FSP**

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The collection of lamprey ammocoetes in the field was performed with no deviations from the FSP.

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**Figure 2-1. Siletz River Collection Area for Phase 1 Lamprey (*Lampetra* sp.) Ammocoete**  
**DRAFT**

### 3.0 LABORATORY METHODS

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This section describes the methods used to hold the lamprey ammocoetes in the laboratory, the toxicity and temperature testing methods, the analytical methods of the confirmatory water samples, and deviations from the FSP and quality assurance plan (QAPP).

#### 3.1 LAMPREY AMMOCOETE HOLDING

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Upon receipt of the ammocoetes at the laboratory, the water temperature was measured in the coolers, and the ammocoetes were transferred into 10-gal. tanks with approximately 50 organisms per tank. The tanks contained approximately 2 to 3 in. of sediment and 26 L of water that was aerated. The water was supplied using a flow-through system at a rate of approximately 35 mL/minute (approximately two volume changes per day). In addition, two-thirds of the water volume in each tank were replaced daily. The tanks were held at a temperature of  $12.3^{\circ} \pm 0.5^{\circ} \text{C}$  and ambient laboratory lighting (50 to 73 foot-candles) at a daily photoperiod of 16 hours of light and 8 hours of darkness.

Upon receipt of all ammocoetes, a representative subsample of six ammocoetes was selected, and the six ammocoetes were weighed and measured for length. They ranged from 28 to 84 mm in length and from 0.04 to 0.78 g in weight. The ammocoetes were acclimated in the laboratory for 2 to 3 weeks before testing was initiated. Normal behavior for lamprey ammocoetes is to immediately burrow in sediment and remain there. If any individuals are observed swimming around and not burrowing, it is an indication that the ammocoetes are under some sort of stress. A total of six lamprey were found dead on the sediment surface within the first few days after laboratory receipt of the animals, probably from being damaged during field sampling. Four lamprey from the 10/18/06 batch died, and two lamprey from the 10/24/06 batch died. None of these animals were able to burrow in the sediment. All other lamprey ammocoetes burrowed in the sediment and were not observed swimming in the water column. Lamprey ammocoetes were not fed during the first month of holding on the recommendation of William Swink, MS, a research fishery biologist with the US Geological Survey (USGS) at the Hammond Bay Biological Station.<sup>1</sup> Table 3-1 summarizes the water quality conditions in the tanks during the first 4 weeks of holding. Additional details on the ammocoete holding conditions are presented in Appendix B.

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<sup>1</sup> Mr. Swink has more than 15 years of experience working with sea lamprey, including culture of larval lampreys; effects of density on growth of larvae; and survival, growth, and feeding of newly metamorphosed lampreys.

Table 3-1. Water quality conditions during holding

Parameter	Unit	Mean $\pm$ SD
Temperature	° C	12.3 $\pm$ 0.5
Dissolved oxygen	mg/L	10.9 $\pm$ 0.6
pH	unitless	7.6 $\pm$ 0.4
Conductivity	$\mu$ mh/cm	129 $\pm$ 5
Hardness	mg/L as CaCO <sub>3</sub>	48 $\pm$ 4
Alkalinity	mg/L as CaCO <sub>3</sub>	44 $\pm$ 9

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

After completion of the last range-finding test, the remaining lamprey ammocoetes were fed 50 mL of yeast slurry (2 g yeast in 400 mL water). The flow was turned off prior to feeding and resumed after 24 hours. After feeding, the ammocoetes were separated into two different temperature-controlled rooms (12° and 17° C). The ammocoetes that were placed in the 17° C room were acclimated for 10 days before the temperature test was initiated. Table 3-2 summarizes the water quality conditions in the tanks during the 10 days of holding. After initiation of the first temperature test, the temperature in the room that was held at 17° C was raised to 22° C. The ammocoetes were acclimated for 7 days to the 22° C before the second temperature test was initiated. Table 3-3 summarizes the water quality conditions in the tanks during the 7 days of holding. All remaining lamprey ammocoetes were destroyed after successful completion of the second temperature test.

Table 3-2. Water quality conditions during the 12° C versus 17° C holding

Parameter	Unit	12° C Mean $\pm$ SD	17° C Mean $\pm$ SD
Temperature	° C	11.7 $\pm$ 0.2	15.3 $\pm$ 1.8 <sup>a</sup>
Dissolved oxygen	mg/L	11.3 $\pm$ 0.2	10.0 $\pm$ 0.7
pH	unitless	7.5 $\pm$ 0.1	7.5 $\pm$ 0.2
Conductivity	$\mu$ mh/cm	136 $\pm$ 9	138 $\pm$ 6
Hardness	mg/L as CaCO <sub>3</sub>	57 $\pm$ 5	58 $\pm$ 4
Alkalinity	mg/L as CaCO <sub>3</sub>	44 $\pm$ 7	44 $\pm$ 5

<sup>a</sup> The mean temperature includes all measurements from the initiation of the temperature increase in the holding tank until the test initiation.

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

Table 3-3. Water quality conditions during the 12°C versus 22°C holding

Parameter	Unit	12° C Mean ± SD	22° C Mean ± SD
Temperature	° C	11.6 ± 0.4	19.7 ± 1.8 <sup>a</sup>
Dissolved oxygen	mg/L	10.9 ± 0.3	8.8 ± 0.1
pH	unitless	7.2 ± 0.2	7.3 ± 0.1
Conductivity	µmhos/cm	134 ± 9	153 ± 9
Hardness	mg/L as CaCO <sub>3</sub>	55 ± 5	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	39 ± 4	39 ± 8

<sup>a</sup> The mean temperature includes all measurements from the initiation of the temperature increase in the holding tank until the test initiation.

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

### 3.2 LAMPREY AMMOCOETE TESTING

Phase 1 toxicity testing consisted of range-finding tests with five of the six chemicals (i.e., copper, aniline, pentachlorophenol, diazinon, and lindane). Static renewal testing with naphthalene was explored. However, because of the volatility of this chemical, it was decided, in cooperation with EPA and its partners, to postpone testing with naphthalene until the flow-through testing effort in Phase 2. The range-finding tests were 96-hour static renewal tests (water-only tests). The tests were conducted with a control and four widely spaced concentrations in a logarithmic series. The tests included one replicate that contained five ammocoetes for each concentration and the control. The loading rate ranged from 0.38 to 1.05 g of organism/L. The tests were conducted in soft water (45 ± 9 mg/L as CaCO<sub>3</sub>), at a temperature of 12° ± 1.0° C, and with a light cycle of 16 hours of light and 8 hours of darkness at a light intensity ranging from 50 to 73 foot-candles. The ammocoetes were not fed during the range-finding tests. At 48 hours into the test, approximately 80% of the water was renewed. The numbers of live and dead ammocoetes were counted daily and at test termination in the control and the four test concentrations. At test termination, the lengths and weights of all control ammocoetes were measured. The average length was 67 ± 11 mm, and the average weight 0.45 ± 0.20 g.

The concentrations of the five chemicals (i.e., copper, pentachlorophenol, lindane, diazinon, and aniline) used in the range-finding tests were selected by NAS based on LC50s (concentrations that are lethal to 50% of an exposed population) for other fish presented in literature, the results of the small, preliminary range-finding tests conducted prior to the range-finding tests, and best professional judgment. The small, preliminary range-finding tests consisted of 96-hour exposures of a single lamprey ammocoete in one replicate to a wide range of concentrations for each chemical. The number of concentrations ranged from three and a control for naphthalene to six and a control for copper. Thus, for example, the preliminary range-finding test for copper was conducted on seven ammocoetes in seven replicates, each exposed to a different concentration. Based on the preliminary range-finding test with naphthalene and additional chemistry

work (getting the naphthalene into solution and keeping it in solution), testing with naphthalene was delayed until Phase 2.

The nominal concentrations prepared for each chemical by the toxicity testing laboratory and used in the range-finding tests were confirmed through chemical analyses. Water samples were collected from the control and each test concentration at test initiation, 48-hour renewal (new and old solutions), and test termination. Additional information on chemical purity and the preparation of stock solutions is presented in Appendix B.

After completion of the range-finding tests, additional testing, as requested by EPA and its partners, was performed to evaluate the effects of temperature on lamprey ammocoetes. Two temperature tests were performed: one comparing survival in 12°C water with survival in 17°C water, and another comparing survival in 12°C water with survival in 22°C water. These tests were performed in four replicates with five organisms per replicate.

Because there is no standard protocol for acute toxicity testing with lamprey ammocoetes, the test procedures were based on the methods for measuring acute toxicity with other fish species as described in EPA (2002) and American Society for Testing and Materials (ASTM) (1996) guidance. The test conditions and test acceptability criterion are summarized in Table 3-4.

Table 3-4. Summary of test conditions for the 96-hour acute range-finding toxicity tests and temperature tests with lamprey ammocoetes (*Lampetra* sp.)

Parameter	Condition or Regimen
Test type	static renewal
Test duration	96 hours
Temperature	12° ± 1° C; 17° ± 1° C; and 22° ± 1° C
Light quality	ambient laboratory
Illuminance	49.5 to 73.0 foot-candles
Photoperiod	16 light:8 dark
Test chamber size	9.5-L glass aquaria covered with Plexiglas plates
Solution volume	2.8 L per aquarium
Renewal of test solution	once at 48 hours
Test organisms	lamprey ammocoetes
Number of test treatments	4 test treatments for the range-finding tests
Number of replicates per treatment	1 replicate for the range-finding tests; 4 replicates for the temperature tests
Organisms per replicate	5 organisms per replicate (loading rate between 0.38 and 1.05 g/L)
Number of organisms per exposure concentration	5 organisms per exposure concentration in range-finding tests; 20 organisms per exposure temperature in temperature tests
Test chamber cleaning	none
Feeding	none
Aeration	gentle aeration not exceeding 100 bubbles/min.

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Table 3-4. Summary of test conditions for the 96-hour acute range-finding toxicity tests and temperature tests with lamprey ammocoetes (*Lampetra* sp.)

Parameter	Condition or Regimen
Dilution water	de-chlorinated municipal tap water with a hardness of $45 \pm 9$ mg/L spiked with the selected chemicals
Test concentrations	4 test concentrations and a control
Endpoint	survival
Test acceptability criterion	$\geq 90\%$ survival in the control

### 3.3 WATER ANALYTICAL METHODS

The nominal test solution concentrations used in each 96-hour range-finding test were confirmed by Columbia Analytical Services, Inc. (CAS), of Kelso, Washington. Test solution samples were collected during test initiation, 48-hour renewal (new and old solutions), and test termination and shipped to CAS. Samples were analyzed according to the methods presented in Table 3-5.

Table 3-5. Laboratory Methods for the Analysis of Toxicity Test Solution Samples

Chemical	Laboratory Method	
	Sample Preparation	Quantitative Analysis
Copper	EPA 3005/CLP	EPA 200.8
Lindane	EPA 3535	EPA 8081A
Diazinon	EPA 3520C	EPA 8141A
Aniline	EPA 3520C	EPA 8270C
Pentachlorophenol	EPA 8151M	EPA 8151M

EPA – US Environmental Protection Agency

Data validation was completed by EcoChem in Seattle, Washington. Data quality is acceptable and meets the objectives of the lamprey toxicity study. EcoChem's data validation report is provided in Appendix D.

### 3.4 DEVIATIONS FROM THE FSP AND QAPP

Lamprey ammocoetes were not fed during the first month of holding on the recommendation of William Swink, MS, a research fishery biologist with the USGS at the Hammond Bay Biological Station. After chemical testing was completed, holding was extended beyond the initial planned duration, so the remaining lamprey ammocoetes were fed a yeast slurry based on the methods used by USGS at the Hammond Bay Biological Station.



Dilution water hardness was 51 mg/L as CaCO<sub>3</sub> in all batches of test water used. This is slightly above the water hardness listed in the QAPP (< 50 mg/L). Collection site water hardness ranged from 20 to 51 mg/L.

The loading rate of 1.1 g/L recommended in the EPA protocol (EPA 2002) and cited in the QAPP was not exceeded. However, in the conditional approval letter received on October 31, 2006, EPA recommended using the ASTM loading rate of 0.8 g of organism/L. This lower loading rate was exceeded in the range-finding tests with aniline (0.96 g/L), diazinon (0.93 g/L), 12°C versus 17°C (0.98 and 1.05 g/L, respectively), and in 12°C of the 12°C versus 22°C (0.86 g/L).

Chemical analyses of the test solution samples were completed as described in the QAPP, with one exception. Analyses for pentachlorophenol were completed using EPA method 8151M rather than method 8270C, which was stated in the QAPP. Method 8151M provides a lower detection limit at a lower cost than method 8270C and had been used for the analysis of pentachlorophenol in sediment samples. The use of method 8151M did not affect data quality and improved method sensitivity. There were no other deviations from the QAPP during the analysis and validation of Phase 1 test solution samples.

Additional water samples at a frequency of 5% of the samples were not collected for chemistry laboratory QC.

## 4.0 TESTING RESULTS

The test results for the five range-finding tests are presented in Section 4.1, and the test results from the temperature tests are presented in Section 4.2.

### 4.1 RANGE-FINDING TESTS

This section presents the test results and water quality conditions documented during the range-finding test with the five chemicals. Temperature, dissolved oxygen, and pH were measured daily in all concentrations. Conductivity, hardness, and alkalinity were measured daily in the control and highest concentration.

#### 4.1.1 Copper

The 96-hour range-finding test with copper was initiated November 9, 2006, and terminated November 13, 2006. The daily survival rates documented throughout the test and the nominal and mean measured chemical concentrations are presented in Table 4-1. The test met the acceptability criterion of  $\geq 90$  percent survival in the control. The concentrations of copper measured throughout the test are presented in Table 4-2; water quality conditions are summarized in Table 4-3.

Table 4-1. Daily survival of ammocoetes and chemical concentrations of copper

Concentration ( $\mu\text{g/L}$ )		Number of Surviving Ammocoetes					Percent Survival
Nominal	Measured Mean $\pm$ SD	0 hour	24 hours	48 hours	72 hours	96 hours	
0 (control)	$6.88 \pm 1.69$	5	5	5	5	5	100
1	$7.48 \pm 1.73$	5	5	5	5	5	100
10	$14.6 \pm 3.42$	5	5	5	5	5	100
100	$84.9 \pm 6.83$	5	5	5	5	2	40
1,000	$1,020 \pm 59$	5	0	0	0	0	0

SD = standard deviation

Table 4-2. Copper concentrations throughout the range-finding test

Nominal Concentration ( $\mu\text{g/L}$ )	Measured Concentration ( $\mu\text{g/L}$ )			
	0 hour	48 hours – Old Solution	48 hours – New Solution	96 hours
0 (control)	8.49	8.17	5.20	5.64
1	9.81	7.62	6.71	5.76
10	19.1	11.7	15.4	12.2
100	93.9	80.0	90.6	80.0 <sup>a</sup>
1,000	1,070 <sup>a</sup>	927	1,050	999

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<sup>a</sup> Average including a duplicate.

Table 4-3. Water quality conditions during range-finding test with copper

Parameter	Unit	Mean $\pm$ SD
Temperature	° C	12.3 $\pm$ 0.2
Dissolved oxygen	mg/L	10.5 $\pm$ 0.2
pH	unitless	7.3 $\pm$ 0.2
Conductivity	$\mu$ mhos/cm	113 $\pm$ 4
Hardness	mg/L as CaCO <sub>3</sub>	51 $\pm$ 0
Alkalinity	mg/L as CaCO <sub>3</sub>	40 $\pm$ 0

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

#### 4.1.2 Aniline

The 96-hour range-finding test with aniline was initiated November 9, 2006, and terminated November 13, 2006. The daily survival rate documented throughout the test and the nominal and mean measured chemical concentrations are presented in Table 4-4. The test met the acceptability criterion of  $\geq 90$  percent survival in the control. The concentrations of aniline measured throughout the test are presented in Table 4-5; water quality conditions are summarized in Table 4-6.

Table 4-4. Daily survival of ammocoetes and chemical concentrations of aniline

Concentration (mg/L)		Number of Surviving Ammocoetes					Percent Survival
Nominal	Measured Mean $\pm$ SD	0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	
0 (control)	0.017 $\pm$ 0.019	5	5	5	5	5	100
1.0	0.795 $\pm$ 0.128	5	5	5	5	5	100
10	8.23 $\pm$ 0.150	5	5	5	5	5	100
100	91.3 $\pm$ 16.5	5	5	5	5	5	100
1,000	1,087 $\pm$ 103	5	5	2	2	0	0

SD – standard deviation

Table 4-5. Aniline concentrations throughout the range-finding test

Nominal Concentration (mg/L)	Measured Concentration (mg/L)			
	0 Hour	48 Hours – Old Solution	48 Hours – New Solution	96 Hours
0 (control)	0.002 J	0.044	5.8 J	15 J
1.0	0.61	0.81	0.89	0.87
10	8.3	8.3	8.3	8.0
100	100	75	110	80
1,000	1,100	950	1,200	1,100

J – estimated value

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Table 4-6. Water quality conditions during range-finding test with aniline

Parameter	Unit	Mean $\pm$ SD
Temperature	°C	12.6 $\pm$ 0.2
Dissolved oxygen	mg/L	10.3 $\pm$ 0.2
pH	unitless	7.4 $\pm$ 0.1
Conductivity	$\mu$ mhos/cm	120 $\pm$ 5
Hardness	mg/L as CaCO <sub>3</sub>	51 $\pm$ 0
Alkalinity	mg/L as CaCO <sub>3</sub>	40 $\pm$ 0 and 447 $\pm$ 12 <sup>a</sup>

<sup>a</sup> Alkalinity was 40 mg/L in the control and 447 mg/L in the highest concentration.  
CaCO<sub>3</sub> – calcium carbonate  
SD – standard deviation

#### 4.1.3 Pentachlorophenol

The 96-hour range-finding test with pentachlorophenol was initiated November 9, 2006, and terminated November 13, 2006. The daily survival rate documented throughout the test and the nominal and mean measured chemical concentrations are presented in Table 4-7. The test met the acceptability criterion of  $\geq 90$  percent survival in the control. The concentrations of pentachlorophenol measured throughout the test are presented in Table 4-8; water quality conditions are summarized in Table 4-9.

Table 4-7. Daily survival of ammocoetes and chemical concentrations of pentachlorophenol

Concentration ( $\mu$ g/L)		Number of Surviving Ammocoetes					Percent Survival
Nominal	Measured Mean $\pm$ SD	0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	
0 (control)	0.13 $\pm$ 0.00	5	5	5	5	5	100
4	2.3 $\pm$ 0.57	5	5	5	5	5	100
40	18 $\pm$ 0.50	5	5	5	5	5	100
400	210 $\pm$ 0.41	5	0	0	0	0	0
4,000	2,075 $\pm$ 320	5	0	0	0	0	0

SD – standard deviation

Table 4-8. Pentachlorophenol concentrations throughout the range-finding test

Nominal Concentration (µg/L)	Measured Concentration (µg/L)			
	0 Hour	48 Hours – Old Solution	48 Hours – New Solution	96 Hours
0 (control)	0.13 U	0.13 U	0.13 U	0.13 U
4	3	1.6	2.3	2.2
40	19	18	18	18
400	240	230	220	150
4,000	2,400	2,300	1,800	1,800

U – not detected

Table 4-9. Water quality conditions during range-finding test with pentachlorophenol

Parameter	Unit	Mean ± SD
Temperature	°C	12.3 ± 0.2
Dissolved oxygen	mg/L	10.4 ± 0.1
pH	unitless	7.3 ± 0.2
Conductivity	µmhos/cm	117 ± 5
Hardness	mg/L as CaCO <sub>3</sub>	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	40 ± 0

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

#### 4.1.4 Lindane

The 96-hour range-finding test with lindane was initiated November 9, 2006, and terminated November 13, 2006. The daily survival rate documented throughout the test and the nominal and mean measured chemical concentrations are presented in Table 4-10. The test met the acceptability criterion of ≥ 90 percent survival in the control. The concentrations of lindane measured throughout the test are presented in Table 4-11; water quality conditions are summarized in Table 4-12.

Table 4-10. Daily survival of ammocoetes and chemical concentrations of lindane

Concentration (µg/L)		Number of Surviving Ammocoetes					Percent Survival
Nominal	Measured Mean ± SD	0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	
0 (control)	0.74 ± 0.51	5	5	5	5	5	100
8	4.6 ± 1.5	5	5	5	5	5	100
80	36 ± 16	5	5	5	5	5	100
800	345 ± 189	5	5	5	5	5	100
8,000	3,215 ± 2,002	5	0	0	0	0	0

SD – standard deviation

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Table 4-11. Chemical concentrations of lindane throughout the range-finding test

Nominal Concentration (µg/L)	Measured Concentration (µg/L)			
	0 Hour	48 Hours – Old Solution	48 Hours – New Solution	96 Hours
0 (control)	1.3	0.81	0.053	0.78 J
8	5.3	2.8	6.1	4.0
80	47	17	50	28
800	430	220	570	160
8,000	4,400	260	4,500	3,700

J – estimated value

Table 4-12. Water quality conditions during range-finding test with lindane

Parameter	Unit	Mean ± SD
Temperature	°C	12.3 ± 0.2
Dissolved oxygen	mg/L	10.3 ± 0.2
pH	unitless	7.4 ± 0.1
Conductivity	µmhos/cm	117 ± 3
Hardness	mg/L as CaCO <sub>3</sub>	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	40 ± 0

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

#### 4.1.5 Diazinon

The 96-hour range-finding test with diazinon was initiated November 16, 2006, and terminated November 20, 2006. The daily survival rate documented throughout the test and the nominal and mean measured chemical concentrations are presented in Table 4-13. The test met the acceptability criterion of ≥ 90 percent survival in the control. The concentrations of diazinon measured throughout the test are presented in Table 4-14; water quality conditions are summarized in Table 4-15.

Table 4-13. Daily survival of ammocoetes and chemical concentrations of diazinon

Concentration (µg/L)		Number of Surviving Ammocoetes					Percent Survival
Nominal	Measured Mean ± SD	0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	
0 (control)	2.5 ± 1.7	5	5	5	5	5	100
40	23 ± 16	5	5	5	5	5	100
400	190 ± 70	5	5	5	5	5	100
4,000	1,518 ± 825	5	5	5	5	5	100
40,000	13,175 ± 5,960	5	5	0	0	0	0

SD – standard deviation

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Table 4-14. Chemical concentrations of diazinon throughout the range-finding test

Nominal Concentration (µg/L)	Measured Concentration (µg/L)			
	0 Hour	48 Hours – Old Solution	48 Hours – New Solution	96 Hours
0 (control)	4.5	2.6	0.31	2.6
40	29	6.2	41	14
400	190	100	270	200
4,000	1,800	570	2,500	1,200
40,000	16,000	6,700	20,000	10,000

Table 4-15. Water quality conditions during range-finding test with diazinon

Parameter	Unit	Mean ± SD
Temperature	°C	11.9 ± 0.1
Dissolved oxygen	mg/L	10.5 ± 0.1
pH	unitless	7.2 ± 0.1
Conductivity	µmhos/cm	119 ± 4
Hardness	mg/L as CaCO <sub>3</sub>	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	32 ± 4

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

## 4.2 TEMPERATURE TESTS

This section presents the test results and water quality conditions taken during the two temperature tests. Temperature, dissolved oxygen, and pH were measured daily in all concentrations. Conductivity, hardness, and alkalinity were measured daily in the control and highest concentration.

### 4.2.1 Temperature 12°C versus 17°C

The 96-hour temperature test was initiated December 1, 2006, and terminated December 5, 2006. The daily survival rate documented throughout the test is presented in Table 4-16. The test met the acceptability criterion of ≥ 90 percent survival in the control. The water quality conditions are summarized in Table 4-17.

Table 4-16. Daily survival of ammocoetes at 12° and 17° C

Temperature (°C)	Replicate	Number of Surviving Ammocoetes					Percent Survival	
		0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	Replicate	Mean
12° (control)	1	5	5	5	5	5	100	100
	2	5	5	5	5	5	100	
	3	5	5	5	5	5	100	
	4	5	5	5	5	5	100	
17°	1	5	5	5	5	5	100	100
	2	5	5	5	5	5	100	
	3	5	5	5	5	5	100	
	4	5	5	5	5	5	100	

Table 4-17. Water quality conditions during the 12° versus 17° C temperature test

Parameter	Unit	12°C Mean ± SD	17°C Mean ± SD
Temperature	°C	12.3 ± 0.2	16.9 ± 0.4
Dissolved oxygen	mg/L	10.7 ± 0.4	9.1 ± 0.3
pH	unitless	7.2 ± 0.3	7.1 ± 0.2
Conductivity	µmhos/cm	123 ± 4	134 ± 7
Hardness	mg/L as CaCO <sub>3</sub>	51 ± 0	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	30 ± 0	30 ± 0

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

#### 4.2.2 Temperature 12°C versus 22°C

The 96-hour temperature test was initiated December 8, 2006, and terminated December 12, 2006. The daily survival rate documented throughout the test is presented in Table 4-18. The test met the acceptability criterion of ≥ 90 percent survival in the control. The water quality conditions are summarized in Table 4-19.

Table 4-18. Daily survival of ammocoetes at 12° and 22° C

Temperature (°C)	Replicate	Number of Surviving Ammocoetes					Percent Survival	
		0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	Replicate	Mean
12° (control)	1	5	5	5	5	5	100	100
	2	5	5	5	5	5	100	
	3	5	5	5	5	5	100	
	4	5	5	5	5	5	100	

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Table 4-18. Daily survival of ammocoetes at 12° and 22° C

Temperature (°C)	Replicate	Number of Surviving Ammocoetes					Percent Survival	
		0 Hour	24 Hours	48 Hours	72 Hours	96 Hours	Replicate	Mean
22°	1	5	5	5	5	5	100	95
	2	5	5	5	5	4	80	
	3	5	5	5	5	5	100	
	4	5	5	5	5	5	100	

Table 4-19. Water quality conditions during the 12° versus 17° C temperature test

Parameter	Unit	Temperature Test	
		12° C Mean ± SD	22° C Mean ± SD
Temperature	° C	12.2 ± 0.3	22.3 ± 0.5
Dissolved oxygen	mg/L	10.5 ± 0.4	8.3 ± 0.3
pH	unitless	7.1 ± 0.2	7.2 ± 0.2
Conductivity	µmhos/cm	120 ± 8	146 ± 9
Hardness	mg/L as CaCO <sub>3</sub>	51 ± 0	51 ± 0
Alkalinity	mg/L as CaCO <sub>3</sub>	33 ± 6	37 ± 6

CaCO<sub>3</sub> – calcium carbonate

SD – standard deviation

## **5.0 CONCLUSIONS**

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The specific objectives of the Phase 1 lamprey ammocoete collection and testing effort stated in Section 1.1 were all met with two exceptions. A range-finding test with naphthalene could not be performed using the static renewal method because of the volatility of the chemical. Therefore, the range-finding test with naphthalene was delayed until Phase 2 testing when it will be performed as a flow-through test. Similarly, the development of a proper flow-through exposure system was delayed until Phase 2.

## **6.0 REFERENCES**

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EPA. 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. Fifth edition. EPA-821-R-02-012. Office of Water, US Environmental Protection Agency, Washington, DC.

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Integral, Windward, Kennedy/Jenks, Anchor, Groundwater Solutions. 2004. Portland Harbor RI/FS programmatic work plan. Prepared for Lower Willamette Group. Integral Consulting, Inc., Mercer Island, WA; Windward Environmental LLC, Seattle, WA; Kennedy/Jenks Consultants, Portland, OR; Anchor Environmental, LLC, Seattle, WA; Groundwater Solutions, Inc., Portland, OR.

## **APPENDIX A. FIELD COLLECTION LOGBOOKS AND CHAIN-OF-CUSTODY FORMS**

---



10.17.06

T.D.

0815 Arrive at Strom Park Boat Ramp.

Weather: partly cloudy, clearing,  
50's warming to low 60's later.

Crew: Thai Do (Windward Env. LLC)

Matt Luxon (Windward Env. LLC)

0830 set up: launch canoe, review backpack  
electroshocking equipmentWe decided that before we begin,  
we will make sure the settings  
are correct and will perform some  
trial runs right off the boat  
launch area. The default settings are  
not appropriate so we will reset them.  
Backpack electroshocker is set to duplicate.Setting 1

3 pulses/sec

125 V 25% duty cycle

Setting 2

30 pulses

125 V 25% duty cycle

0845 Depart boat launch and headed  
just upstream to look for suitable  
reach area with habitat: depositional  
areas with a nice flow/current.

10.17.06

T.D.

0900 Unsuccessful upstream of boat launch  
so we will head downstream  
and will shock any areas that  
seem suitable.1345 We canoed downstream about two  
miles and were unsuccessful at  
every location we tried. We  
returned to the boat launch at  
Strom Park to take a lunch break.1415 Depart Strom Park boat launch.  
Headed to Cedar Creek area, an  
area advised by Stan van de  
Wijning (Siletz), a high immediate  
yield area.1430 Arrive at Cedar Creek area. We  
decided to work here for the rest  
of the day.1620 This area was successful. We  
collected 90 acceptable sized  
(0.5-9 cm) ammocoetes. We  
collected a jar of site water for  
the lab to test for hardness.  
The in-situ temperature was  
measured at 12.9°C. The area

10.17.06

T. Do

we caught these ammocoetes had a nice steady, but slow, current. Substrate was fine sands with a silty layer, sparsely vegetated, and leaf litter. The water temp was measured about 3" from the surface, and may be slightly colder at the bottom where the sediment: water interface is. That portion of the river was about knee high.

to

1625

Depart Cedar Creek area; headed to Northwestern Aquatic Sciences to drop off ammocoetes and water samples.

to

1645

Arrive at NAS. Off load samples.

1655

Sign off samples to NAS.

1700

Depart NAS, End of field day.

T. Do

10.17.06

10.18.06

T. Do

0800 Arrived at NAS to pick up coolers and gel ice packs for continued ammocoete collection on the Siletz River.

Crew: Thai Do (Windward)

Met Luxon (Windward)

Weather: overcast, 50's, v. light showers, (infrequent)

0830 Arrive at Cedar Creek area. Set up equipment.

0900 Begin sampling/electroshocking.

Water temp: 12.6°C.

1200 Lunch break

1230 Resume sampling/electroshocking

1430 End of sampling because we have

to drop off ammocoetes at NAS, and

still have to drive in to Corvallis, OR

to return the rental canoe by

1700. Loaded samples and gear.

Each cooler contains ~50 ammocoetes.

Site sediment (fine sands w/silt) is

placed inside (~2-3 inches) with site

water before we release the captured

ammocoetes into the coolers. The inside

lids have frozen gel ice packs affixed

10.18.06

T.D.

to men to keep the water temp.  
cool during transport to N.A.S.

1500 Arrived at N.A.S. to drop off ammocoetes.

1510 Sign-off samples - ~250 ammocoetes.

1530 Depart N.A.S. head to Peak Sports  
in Conwallis to return rental canoe.

1700 Arrive in Conwallis. Return canoe.

1715 Depart for Portluzid. End of  
field day.

~~10.18.06~~  
~~T.D.~~

10.23.06

T.D.

0800 Arrived at N.A.S. to pick up coolers  
and ice gel packs for continued  
ammocoete collection on Siletz River  
for toxicity testing.

Crew: Thai Do (Windward)

Jenny Bueving (Windward)

Weather: Fog clearing to sunny,  
40<sup>°</sup> to 50<sup>°</sup> F to mid to high 50<sup>°</sup> F later

0830 Arrive at Cedar Creek area along  
Siletz River. Health and safety  
briefing for Jenny.

0835 Begin setting up equipment.

0945 Screw clamp for anode ring is  
missing. Unable to sample without  
it. Called Windward to find out if  
it was left behind at field gear  
room → no.

0915 Attempt to jury-rig anode ring  
with wire and eye screw... will  
search for missing piece near  
parking area.

0930 Unable to locate. Return to  
Newport to find hardware to jury-  
rig shadler equipment.



10.23.06

T.D.

0945 Called Smith-Root (shocker rental place) and asked if they could Fed-Ex ~~and~~ <sup>10:30:06</sup> an overnight package for the snow clamp. They said someone is actually coming to Newport today so they can drop off the replacement part with us later today.

1000 Purchased hardware for temporary fix of anode ring.

1015 Gary Bulter (NAS) found the part in NAS parking lot.

1020 We head back to sampling site

1100 Arrived back at Cedar Creek area.

1130 Lunch break

1145 Set up and begin sampling.

In situ water temperature = 12.1°C.

Water level appears a little higher, probably from recent rain last week.

End of sampling. Load up vehicle with samples

1630 Headed to N.A.S. to drop off samples

1700 Arrived at N.A.S.

1710 Sign-off samples ~200 ammometes.

10.23.06

T.D.

1730 Depart N.A.S. End of field day  
2010 Called Joe Gouldt in response to Weiland's message asking for an update. Left him a message with the tally (~200) collected for today.

2100 Received spare anode ring & clamp from Smith-Root representative.

10.23.06

10.23.06

10.24.06

0800 Arrived at N.A.S. to pick up coolers and ice gel packs for continued ammocoete collection on the Siletz River. Prepped coolers w/ ice packs.

Crew: Thai Do (Windward)

Jenny Buehning (Windward)

Weather: rain showers to partly sunny. 40°s F. to low-mid 50°s F.

0845 Arrive at Cedar Creek area along the Siletz River; set up sampling equipment/gear.

0910 Begin sampling/electroshocking.

Water temp: 11.8°C.

1315 Lunch break

1345 Resume sampling/electroshocking.

1700 End of sampling. All 300 ammocoetes collected.

1715 Depart to N.A.S. to drop off samples.

1745 Arrive at N.A.S. Offload samples.

1750 Sign off ammocoetes to L.A.S. 6 coolers ~ 300 ammocoetes.

1815 Depart N.A.S.; mobilise to Portland (stopover before

T.D.

10.24.06

T.D.

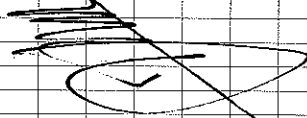
Returning to Seattle.

2100 Arrive in Portland. End of field day.

10.24.06

2230 Called Joe Gorbet (EPA) to give him today's tally. Will return shooter equip. to Smith-Doot Inc en route to Seattle (in Vancouver) tomorrow.

10.24.06



2409  
Z

Project/Client Name: W19 RA Lamprey ammocoete

Project Number: \_\_\_\_\_

Contact Name: Helle Andersen

Sampled By: TDO, Muxton

Ship to: U.A.S.

Attn: Gary Buhler

Shipping Date:

Airbill Number:

Turnaround requested:

[illegible]

\* Distribution: White copies accompany shipment; yellow retained by consignor.

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

Windward<sup>LLC</sup>  
environmental

**To be completed by Laboratory upon sample receipt:**

Date of receipt:..	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

2407

Ship to: U. A. S.

Attn: Engr. D. B. L.

Attn: Gary Buhler

Shipper: hand del'd

Form filled out by: F B

Turnaround requested:

[illegible]

\* Distribution: White copies accompany shipment; yellow retained by consignor.

**To be completed by Laboratory upon sample receipt:**

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

Date of receipt:	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

**Windward**  
environmental LLC

Project/Client Name: LWA EIA - Murphy amendment (toxicity)  
Project Number: 06-28-04-45  
Contact Name: Helle Andersen  
Sampled By: TDO J Bueving

Ship to: N.A.S.  
Attn: Gary Bunker  
Shipper: hand del'd.  
d out by: T.D.

Shipping Date: \_\_\_\_\_  
Airbill Number: \_\_\_\_\_  
 turnaround requested: \_\_\_\_\_

[illegible]

\* Distribution: White copies accompany shipment; yellow retained by consignor.

**To be completed by Laboratory upon sample receipt:**

Date of receipt::	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

200 West Mercer Street

Suite 401

Seattle, WA 98119

Tel: (206) 378-1364

Tel: (206) 378-1364  
 Fax: (206) 217-9343



Project/Client Name: LNKs EPA - lamprey ammoxete (toxicity)

Project Number: 06-28-04-45

Contact Name: Helle Andersen

Sampled By: TDO JBuening

Ship to: NAS

Attn: Gray Buhler

Shipper: hand del'd

Form filled out by: TDO

Shipping Date: \_\_\_\_\_

Airbill Number: \_\_\_\_\_

Turnaround requested: \_\_\_\_\_

[illegible]

\* Distribution: White copies accompany shipment; yellow retained by consignor.

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

Windward<sup>LLC</sup>  
environmental

**To be completed by Laboratory upon sample receipt:**

Date of receipt::	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

## **APPENDIX B. TOXICITY TESTING REPORT**

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## TOXICITY TEST REPORT

## TEST IDENTIFICATION

Test Nos.: 686-31 through 37

Title: Lamprey (*Lampetra* sp.) ammocoete acute, static renewal range-finding toxicity testing with lamprey ammocoetes (*Lampetra* sp.) in support of the Portland Harbor remedial investigation (RI).

Protocol No.: NAS-686-Lamprey-rf, October 11, 2006 draft.

Study Objectives: The study objectives for the laboratory were to: 1) establish proper methods for holding the ammocoetes in the laboratory, including feeding and temperature regimens; 2) establish the proper exposure system, including size of exposure chambers, flow rate, and feeding regimen; and 3) perform range-finding toxicity tests with the following six chemicals: copper, aniline, pentachlorophenol, naphthalene, diazinon, and lindane. After the study was initiated, naphthalene was dropped from the range-finding testing and testing at two higher temperatures was added.

## STUDY MANAGEMENT

Study Sponsor: Windward Environmental, Inc., 200 West Mercer Street, Suite 401, Seattle, WA 98119.

Sponsor's Study Monitor: Ms. Helle Andersen

Testing Laboratory: Northwestern Aquatic Sciences, P.O. Box 1437, Newport, OR 97365.

Test Location: Newport Laboratory.

Laboratory's Study Personnel: Richard S. Caldwell, Ph.D., G.A. Buhler, B.S., Proj. Man./Study Dir.; L.K. Nemeth, B.A., M.B.A., Acting Lab Director and QA Officer; G.J. Irissarri, B.S., Aq. Toxicol.; G. Hutchinson, B.S., Tech.

Study Schedule: The study began on September 28, 2006 with preparations to receive and hold lamprey in the laboratory. The study schedule required holding the lamprey for two to three weeks after receipt in order to determine whether lamprey ammocoetes could be held successfully in the laboratory. After two to three weeks of holding, four chemicals (aniline, copper, pentachlorophenol, and lindane) were tested on 11-9-06 in 96-hr static renewal tests. Diazinon was tested on 11-16-06. Naphthalene was dropped from the range-finding phase of the study due to the difficulty of keeping it in solution. After the chemical testing started, two more tests were requested to assess the ability of lamprey to acclimate to and survive in water-only tests at higher temperatures (17°C and 22°C). The temperature testing was conducted with remaining lamprey ammocoetes following the successful completion of chemical testing. On 11-21-06, at the end of all chemical testing, remaining organisms were fed, then ammocoetes were separated into different temperature-controlled rooms to acclimate to temperatures for the 96-hr temperature tests which were initiated on 12-1-06 (17°C) and 12-8-06 (22°C). The final test ended on 12-12-06.

Disposition of Study Records: All specimens, raw data, reports and other study records are stored according to Good Laboratory Practice regulations at Northwestern Aquatic Sciences, 3814 Yaquina Bay Rd., Newport, OR 97365.

Good Laboratory Practices: The test was conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

Statement of Quality Assurance: The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol and standard operating procedures. This report is an accurate reflection of the raw data.

## TEST MATERIAL

Description: Chemicals tested included aniline (Fisher Scientific Lot #062904; purity: 99.9% assay), copper as copper sulfate (Argent Lot No. 0195; purity: minimum 99%), pentachlorophenol (Eastman Organic Chemicals), lindane (Aldrich batch # 07325DD; purity: 97%), and diazinon (Chem Service Lot # 362-71A; purity: 98.2%).

Preparation of Working Stock Solution and Test Concentrations: Stock solutions of aniline, pentachlorophenol, lindane, and diazinon, and were prepared by weighing or, in the case of aniline, measuring volumetrically, enough of the chemical to exceed either the saturation levels in water or an amount to exceed the estimated aqueous toxicity concentrations, and adding the chemicals to from 1L to 4L of NAS tap water in clean, acetone-rinsed brown glass bottles fitted with Teflon® caps. Bottles were capped and the contents slowly stirred on a magnetic stirrer at room temperature for ca. 20 hours. Target aqueous concentrations for each

chemical were: lindane, 8.0 mg/L; pentachlorophenol, 40 mg/mL; diazinon, 40 mg/L; and aniline, 1000 mg/L. The copper stock solution was a 1 mg/mL stock prepared on 10-27-05.

## DILUTION WATER

Source: Dechlorinated municipal tap water from the City of Newport.

Dates of Preparation: A tank of dilution water was prepared prior to receipt of lampreys in the laboratory, topped off daily as needed, and constantly aerated. Water was removed for testing, or for aerated temperature acclimation prior to testing, on 11-9-06, 11-16-06, 11-30-06 and 12-7-06.

Water Quality: Ranges for parameters were: conductivity 110-130  $\mu$ mhos/cm and alkalinity 30-40 mg/L as  $\text{CaCO}_3$ . In all batches of dilution water hardness was 51 mg/L as  $\text{CaCO}_3$ , and pH was 7.2. All total chlorine measurements were <0.02 mg/L.

Pretreatment: Dechlorinated, aerated  $\geq 24$  hr.

## TEST ORGANISMS

Species: Lamprey, *Lampetra* sp.

Age: ammocoetes

Size: An initial representative subsample of six lampreys was measured after lab receipt of all animals. Pretest lamprey ammocoetes ranged from 28 to 84 mm in length and 0.04 to 0.78 g in weight. At the end of each test, lengths and weights were measured on all control animals and the overall means were calculated: average length,  $67 \pm 11$  mm; average weight,  $0.45 \pm 0.20$  g.

Source: Cedar Creek, Siletz River, Oregon. Organisms were collected by Windward staff and delivered to the laboratory.

Acclimation: Lamprey ammocoetes were received on 10-17-06, 10-18-06, 10-23-06, and 10-24-06. In situ water temperatures recorded on chain-of-custodies were 12.9°C, 12.1 °C, and 11.8°C. Average water quality parameters measured in the receiving water at the laboratory were: Temperature,  $12.0 \pm 1.3^\circ\text{C}$  (range 10.6 – 13.6); dissolved oxygen,  $8.8 \pm 0.6$  mg/L (range 8.2 - 9.6); pH,  $6.0 \pm 0.6$  (range 5.3 – 6.8); conductivity,  $96 \pm 39$   $\mu$ mhos/cm (range 62 – 150); hardness,  $31 \pm 11$  mg/L as  $\text{CaCO}_3$  (range 26 – 51); and alkalinity,  $38 \pm 35$  mg/L as  $\text{CaCO}_3$  (range 20 – 90).

Animals were placed in 10-gallon tanks under flow-through conditions ( $\sim 35$  mL/minute, or  $\sim 2$  volume changes per day, with one additional daily siphon and replacement of 2/3 volume of each tank). Approximately 50 lampreys were placed in each tank. Tanks contained 2-3 inches of sediment (Sandtastic Play Sand, Waupaca Materials) covered with 26L of test water and supplied with aeration. Normal behavior for lamprey ammocoetes is to immediately bury in sediment and remain there. If any are observed swimming around and not burying, that indicates some sort of stress. A total of six lampreys were found dead on the sediment surface within the first few days after receipt of animals, probably from being damaged during field sampling. Four lampreys from the 10/18/06 batch died and two from the 10/24/06 batch died. None of these animals were able to bury in the sediment. All other lampreys buried into the sediment and were not observed swimming in the water column.

Since lampreys were to be held short-term (a few weeks), they were not fed during this time. Water quality conditions for the three weeks prior to initiating the first tests (686-31 through -34) averaged: Temperature,  $12.3 \pm 0.5^\circ\text{C}$ ; dissolved oxygen,  $10.9 \pm 0.6$  mg/L; pH,  $7.6 \pm 0.4$ ; conductivity,  $129 \pm 5$   $\mu$ mhos/cm; hardness,  $48 \pm 4$  mg/L as  $\text{CaCO}_3$ ; and alkalinity,  $44 \pm 9$  mg/L as  $\text{CaCO}_3$ . Further acclimation data for individual tests is summarized in Appendix II. Approximately four weeks after animal receipt, remaining lampreys were fed a yeast slurry (2 g yeast in 400 mL tap water blended for  $\sim 1$  minute). The flow was turned off and 50 mL of slurry was fed to each tank. Flow was resumed after 24 hours. Lampreys were then further acclimated to remaining test temperatures.

## TEST PROCEDURES AND CONDITIONS

Test Chambers: The test chambers were 2.5-gallon glass aquaria, containing 2.8L of test solution each, and were covered with plastic lids.

**Test Concentrations:** Four test concentrations and a control were used for each test. Test concentrations were determined by 96-hr exposures of a single lamprey to each of a wide range of three to six concentrations for each chemical. Nominal concentrations used for range-finding testing of each chemical were:

Aniline: 1000, 100, 10, 1.0 and 0 mg/L

Copper: 1.0, 0.1, 0.01, 0.001, and 0 mg/L

Pentachlorophenol: 4.0, 0.4, 0.004, and 0 mg/L

Lindane: 8.0, 0.8, 0.08, 0.008, and 0 mg/L

Diazinon: 40, 4.0, 0.4, 0.04, and 0 mg/L

**Replicates/Treatment:** 1 for chemical tests; 4 for temperature tests

**Organisms/Treatment:** 5 for chemical tests; 20 for temperature tests

**Loading:** 0.38 to 1.05 g/L

**Aeration:** Yes

**Feeding:** None

**Water Volume Changes:** For all testing, solutions were renewed at 48 hours with fresh solution. For chemical tests, new stock solutions were started mixing 24 hours prior to renewal.

**Effects Criteria:** The effect criteria used in the lamprey range-finding toxicity test was mortality, defined as a lack of visible respiratory movement and absence of response to tactile stimulation.

**Target Water Quality Conditions:** Temperature,  $12 \pm 1^\circ\text{C}$  for chemical tests and 12, 17, or  $22 \pm 1^\circ\text{C}$  for temperature tests; dissolved oxygen,  $\geq 6.0$  mg/L.

**Photoperiod:** 16:8 hr, L:D.

**Light Intensity:** Light intensity for the tests ranged from 49.5 to 73.0 foot-candles. Measurements are recorded on each test bench sheet.

## DATA ANALYSIS METHODS

Percent survival was calculated for each concentration from the raw data. For temperature tests the means were obtained for each treatment. The software employed for these calculations was Microsoft Excel 2000.

## CHEMICAL ANALYSES

For the chemical exposure tests, a sample of test solution was taken directly from each test aquaria at 0-, 48- (both old and new solutions) and 96-hours. Samples were stored at  $4^\circ\text{C}$  in the dark prior to shipment to Columbia Analytical Services. Shipment of samples was generally accomplished the next work day after sampling.

## PROTOCOL DEVIATIONS

Lamprey ammocoetes were not fed during the first month of holding on the recommendation of William Swink, M.S., Research Fishery Biologist with the USGS at Hammond Bay Biological Station. Mr. Swink has extensive experience working with sea lamprey, including culture of larval lampreys; effects of density on growth of larvae; and survival, growth, and feeding of newly metamorphosed lampreys. After chemical testing was completed and holding was to continue past the initial planned time, remaining lampreys were fed a yeast slurry based on the methods used by the USGS at Hammond Bay Biological Station.

Dilution water hardness was 51 mg/L as  $\text{CaCO}_3$  in all batches of test water used. This is slightly above the water hardness listed in the QAPP ( $<50$  mg/L). Collection site water hardness ranged from 20 – 51 mg/L.

## TEST RESULTS

Water quality conditions measured in test aquaria during the 96-hr toxicity tests are summarized in Appendix II. The temperature specification ( $12, 17, \text{ or } 22 \pm 1^\circ\text{C}$ ) was met during the study for each temperature regime. Dissolved oxygen remained near saturation throughout the test (range 8.0 – 11.2 mg/L). The pH was within the range of 6.8 to 7.6, and conductivity measurements were within the range of 110 to 160  $\mu\text{mhos/cm}$ . Hardness remained at 51 mg/L as  $\text{CaCO}_3$  in all tests and alkalinity ranged from 30 to 40 mg/L as  $\text{CaCO}_3$  in all tests except aniline (40 to 460 mg/L as  $\text{CaCO}_3$ ).

The daily tabulations of the numbers of surviving lamprey ammocoetes in each treatment and treatment replicate are shown in Tables 1-7. Although not required for test acceptability in these research range-finding tests, the 96-hr control survival was 100% for all tests in the study, meeting the standard acute test acceptability criterion of 90%.



Table 1. Survival of lamprey ammocoetes, exposed for 96 hours to aniline.

Nominal Conc. (mg/L)	Replicate	Number of Lamprey Surviving					Percent Survival
		0-hr	24-hr	48-hr	72-hr	96-hr	
1,000	1	5	5	2	2	0	0.0
100	1	5	5	5	5	5	100.0
10	1	5	5	5	5	5	100.0
1.0	1	5	5	5	5	5	100.0
0 (control)	1	5	5	5	5	5	100.0

Table 2. Survival of lamprey ammocoetes, exposed for 96 hours to copper.

Nominal Conc. (mg/L)	Replicate	Number of Lamprey Surviving					Percent Survival
		0-hr	24-hr	48-hr	72-hr	96-hr	
1.0	1	5	0	0	0	0	0.0
0.1	1	5	5	5	5	2	40.0
0.01	1	5	5	5	5	5	100.0
0.001	1	5	5	5	5	5	100.0
0 (control)	1	5	5	5	5	5	100.0

Table 3. Survival of lamprey ammocoetes, exposed for 96 hours to pentachlorophenol.

Nominal Conc. (mg/L)	Replicate	Number of Lamprey Surviving					Percent Survival
		0-hr	24-hr	48-hr	72-hr	96-hr	
4.0	1	5	0	0	0	0	0.0
0.4	1	5	0	0	0	0	0.0
0.04	1	5	5	5	5	5	100.0
0.004	1	5	5	5	5	5	100.0
0 (control)	1	5	5	5	5	5	100.0

Table 4. Survival of lamprey ammocoetes, exposed for 96 hours to lindane.

Nominal Conc. (mg/L)	Replicate	Number of Lamprey Surviving					Percent	
		0-hr	24-hr	48-hr	72-hr	96-hr	Survival	
8.0	1	5	0	0	0	0	0.0	
0.8	1	5	5	5	5	5	100.0	
0.08	1	5	5	5	5	5	100.0	
0.008	1	5	5	5	5	5	100.0	
0 (control)	1	5	5	5	5	5	100.0	

Table 5. Survival of lamprey ammocoetes, exposed for 96 hours to diazinon.

Nominal Conc. (mg/L)	Replicate	Number of Lamprey Surviving					Percent	
		0-hr	24-hr	48-hr	72-hr	96-hr	Survival	
40	1	5	5	0	0	0	0.0	
4.0	1	5	5	5	5	5	100.0	
0.4	1	5	5	5	5	5	100.0	
0.04	1	5	5	5	5	5	100.0	
0 (control)	1	5	5	5	5	5	100.0	

Table 6. Survival of lamprey ammocoetes, exposed for 96 hours to 17°C.

Temperature (°C)	Replicate	Number of Lamprey Surviving					96-hr % Survival	
		0-hr	24-hr	48-hr	72-hr	96-hr	Replicate	Mean
17	1	5	5	5	5	5	100.0	100.0
	2	5	5	5	5	5	100.0	
	3	5	5	5	5	5	100.0	
	4	5	5	5	5	5	100.0	
12 (control)	1	5	5	5	5	5	100.0	100.0
	2	5	5	5	5	5	100.0	
	3	5	5	5	5	5	100.0	
	4	5	5	5	5	5	100.0	

Table 7. Survival of lamprey ammocoetes, exposed for 96 hours to 22°C.

Temperature (°C)	Replicate	Number of Lamprey Surviving					96-hr % Survival	
		0-hr	24-hr	48-hr	72-hr	96-hr	Replicate	Mean
22	1	5	5	5	5	5	100.0	95.0
	2	5	5	5	5	4	80.0	
	3	5	5	5	5	5	100.0	
	4	5	5	5	5	5	100.0	
12 (control)	1	5	5	5	5	5	100.0	100.0
	2	5	5	5	5	5	100.0	
	3	5	5	5	5	5	100.0	
	4	5	5	5	5	5	100.0	

## STUDY APPROVAL

Gay Bohler 3/21/07  
Project Manager/Study Director Date

Julie R. Fine 3-21-07  
Quality Assurance Unit Date

Linda K. Nemecek 3/21/07  
Acting Laboratory Director Date

**APPENDIX I**  
**PROTOCOL**



**DRAFT**

**TEST PROTOCOL**

**LAMPREY (*LAMPETRA* sp.)  
RANGE-FINDING TOXICITY TEST**

**1. INTRODUCTION**

1.1 Purpose of Study: The purpose of this test is to perform range finding testing to determine the concentrations of specific chemicals that should be used for definitive testing to determine acute toxicity. The test employs lamprey (*Lampetra* sp.) ammocoetes. This testing is research based rather than for regulatory purposes and changes to procedures may occur as the study develops.

1.2 Summary of Method: Juvenile lampreys (ammocoetes) are exposed for 96 hours to a wide range of concentrations of several specific chemicals in order to find the concentrations that should be used for further testing to determine acute toxicity levels. The range-finding tests will be static-renewal. The test chambers are covered glass containers, each holding a volume of solution large enough to prevent loading from exceeding 1.1 g/L. For this range finding one replicate test chamber with five ammocoetes is employed at each of three or more test concentrations. A dilution water control is also run for each test, and a solvent control is also run if a solvent is required for a specific chemical. If there is a surplus of animals available, two replicates per concentration with five animals per replicate may be employed. Mortality is the effect criterion.

**2. STUDY MANAGEMENT**

2.1 Sponsor's Name and Address:

Windward Environmental LLC  
200 West Mercer Street, Suite 401  
Seattle, WA 98119

2.2 Sponsor's Study Monitor:

Ms. Helle Andersen

2.3 Name of Testing Laboratory:

Northwestern Aquatic Sciences  
3814 Yaquina Bay Road P.O. Box 1437  
Newport, OR 97365

2.4 Test Location: Newport Laboratory

2.5 Laboratory's Personnel to be Assigned to the Study:

Study Director: Gary Buhler  
Quality Assurance Officer: Linda K. Nemeth  
Aquatic Toxicologist: Gerald Irissarri  
Aquatic Toxicologist: Michele Redmond

2.6 Proposed Study Schedule: Range finding tests should begin within two to three weeks of ammocoetes collection. Part of the study is to determine whether lamprey ammocoetes can be held in the laboratory prior to testing.

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2.7 Good Laboratory Practices: The test is conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations effective December 29, 1983 (40 CFR Part 792).

3. TEST MATERIAL

For this study, six chemicals are to be tested if there are sufficient animals and chemicals can be obtained and put into solutions successfully. Copper, naphthalene, pentachlorophenol, lindane, diazinon, and aniline are the chemicals to be tested. These chemicals were selected to represent a range of toxic mode of actions. The chemicals will be purchased by NAS. If the number of ammocoetes is limited then chemicals will be tested in the order listed above. The nominal concentrations prepared for each chemical by the laboratory will be confirmed by chemicals analyses. Water samples will be collected from the control and each test concentration at test initiation and termination in bottles supplied by Columbia Analytical Services. Samples will be shipped via overnight carrier to CAS within 24 hours of collection.

4. DILUTION WATER

Dilution water is dechlorinated municipal water from the City of Newport.

5. TEST ORGANISMS

5.1 Species: Lamprey, *Lampetra* sp.

5.2 Source: Lamprey will be collected from the Siletz River by Windward Environmental and transported to NAS.

5.3. Age: ammocoetes (juveniles)

5.4 Acclimation and Pretest Observation: After receipt of fish at the laboratory, they will be sorted into holding tanks supplied with ~4-6 cm of fine sand, flowing water (dilution water), and aeration. The flow rate will depend on the number and size of the ammocoetes received. Animals will be held for two – three weeks prior to testing. During holding, ammocoetes will be fed yeast and, if necessary, a larval fish food weekly or at a frequency that appears to be appropriate based on observations of laboratory staff. After two weeks of holding, ammocoetes should appear disease-free and unstressed, with fewer than 5% of the organisms dying during the 24 to 48 hours prior to testing. To determine the loading rate and test chamber size, the wet weigh of approximately 10 ammocoetes will be measured before test initiation.

Care must be used to ensure that fish are not subjected to unusual handling or environmental stress either before or during the testing period. Ammocoetes should burrow into the substrate. Fish should be handled only the minimum necessary using suitable dip nets and should not be subjected to more than a 3°C temperature change during any 12-hour period. The dissolved oxygen level must be maintained at a level of 6.0 mg/L or greater. During holding, loading of fish in aquaria should not exceed 10 g/L, and holding water should be replaced at a minimum rate of 2 tank volumes per day. Fish are shielded from any unusual visual stress and treated with a photoperiod of 16 hours light and 8 hours darkness. A daily log of feeding, behavioral observations, mortality, and water quality should be maintained.

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**6. DESCRIPTION OF TEST SYSTEM**

6.1 Test Chambers and Environmental Control: Test chambers are glass containers capable of holding a volume large enough to prevent loading from exceeding 1.1 g/L. Test chambers should be covered. Test chambers are maintained at constant temperature by partial immersion in a temperature-controlled water bath or by holding in a constant temperature room. The system is maintained in a photoperiod-controlled room or enclosure. Aeration is not required unless dissolved oxygen concentration falls below 6.0 mg/L. Aeration rate should not exceed 100 bubbles/minute. If aeration is required, all containers are aerated by slow bubbling of oil-free compressed air through 1 ml disposable pipets.

6.2 Cleaning: All laboratory glassware, including test chambers, is cleaned as described in EPA-821-R-02-012. New glassware and test systems are soaked 15 minutes in tap water and scrubbed with detergent (or cleaned in automatic dishwasher); rinsed twice with tap water; carefully rinsed once with fresh, dilute (10%, V:V) hydrochloric or nitric acid to remove scale, metals, and bases; rinsed twice with deionized water; rinsed once with acetone to remove organic compounds (using a fume hood or canopy); and rinsed three times with deionized water. Test systems and chambers are rinsed again with dilution water just before use.

**7. EXPERIMENTAL DESIGN AND TEST PROCEDURES**

7.1 Experimental Design: The test involves exposure of lamprey ammocoetes to a series of three to five test concentrations and a dilution water control. Exposures are for 96 hours. Each treatment consists of one test chamber each containing five fish. Total randomization is used for the placement of containers in the temperature-controlled room. Test organisms are impartially distributed to the test chambers by adding one to two animals to each chamber and repeating the process until each contains 5 organisms.

7.2 Effect Criterion: The effect criterion used in the lamprey bioassay is mortality, defined as a lack of visible respiratory movement and absence of response to tactile stimulation.

7.3 Test Conditions: The test temperature employed is  $12 \pm 1^\circ\text{C}$ . The photoperiod is 16 hours of light and 8 hours of darkness. Illumination is supplied by ambient laboratory lighting. The dissolved oxygen concentration in each test container must be greater than 6.0 mg/L throughout the test. Test containers are gently aerated if required to maintain the oxygen level. If aeration is employed, all containers are treated equally. In the 96-hr test, the test solutions are renewed at 48 hours at a minimum (more if needed for purposes of specific chemicals in solutions). Loading must not exceed 1.1 g/L.

7.4 Preparation of Test Solutions: Each chemical stock solution is prepared by manual mixing with dilution water to prepare a series of test concentrations. The test dilutions are brought to the test temperature by partial immersion of the test containers in a water bath and, if necessary, are gently aerated until the dissolved oxygen concentration is 6.0 mg/L or greater. A solvent may be required to get some of the chemicals into solution.

7.5 Beginning the Test: The test is begun by adding the organisms to the equilibrated test containers as previously described.

7.6 Feeding: Animals are fed weekly during holding. If deemed necessary, animals will be fed prior to the 48-hour renewal.

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**DRAFT****7.7 Test Duration, Type and Frequency of Observations, and Methods:**

The test duration of the range finding toxicity test is 96-hours. The type and frequency of observations to be made during the test are summarized as follows:

<u>Type of Observation</u>	<u>Times of Observation</u>
<u>Biological Data</u>	
Survival (in each test container)	Daily
<u>Physical and Chemical Data</u>	
Temperature and dissolved oxygen	Daily
pH	Beginning, at renewal, end
Hardness and alkalinity	Beginning and end
Sample for chemical measurement (each concentration and control)	Beginning and end

During the test, dead organisms are removed at least every 24 hours. Dissolved oxygen is measured in each stock test solution using a polarographic oxygen probe calibrated according to the manufacturer's recommendations. The pH is also measured in each stock test solution using a pH probe and a properly calibrated meter with scale divisions of 0.1 pH units. Temperature is measured with a calibrated mercury thermometer or telethermometer. Conductivity is measured with a conductivity meter. Hardness and alkalinity are measured using Hach test kits.

**7.8 Test Acceptability Criterion:** In a range finding test with only five animals in the control, the standard acute control survival criterion of 90% is not realistic. If one animal dies randomly, the test would not meet the criterion. Test acceptability will at the discretion of the study director.

**8. DATA ANALYSIS**

The data generated from the range finding test will be used to estimate the concentrations to be used in later definitive test. Percent survival is calculated for each treatment replicate, and, if there is more than one replicate per concentration, the means are obtained for each treatment level. An LC50 is calculated using Probit, Spearman-Kärber, or Trimmed Spearman-Kärber method.

**9. REPORTING**

The final report of the test results must include all of the following standard information at a minimum: name and identification of the test; the investigator and laboratory; information on the test material; information on the dilution water; detailed information about the test organisms; a description of the experimental design and test chambers and other test conditions including water quality; definition of the effect criteria and other observations; responses, if any, in the control treatment; tabulation and statistical analysis of measured responses; a description of the statistical methods used; any unusual information about the test or deviations from procedures.

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**DRAFT****10. STUDY DESIGN ALTERATION**

Amendments made to the protocol must be approved by the sponsor and study director and should include a description of the change, the reason for the change; the date the change took effect, and the dated signatures of the study director and sponsor. Any deviations in the protocol must be described and recorded in the study raw data.

**11. REFERENCE TOXICANT**

Reference toxicant testing is not practical or required with range finding testing for research purposes.

**12. REFERENCED GUIDELINES**

ASTM. 1996. Standard guide for conducting acute toxicity tests on test materials with fishes, macroinvertebrates, and amphibians. E729-96. American Society for Testing and materials, Philadelphia, PA.

EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Edition). EPA-821-R-02-012. Office of Water, US Environmental Protection Agency, Washington, D.C.

**13. APPROVALS**

\_\_\_\_\_ for Windward Environmental  
Name Date

\_\_\_\_\_ for Northwestern Aquatic Sciences  
Name Date

## **APPENDIX II**

### **RAW DATA**

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS – HOLDING DATA**

**ANIMAL RECEIPT/HOLDING: FRESHWATER**  
**SPECIES: *Lampetra tridentata* (Pacific Lamprey)**

SP- 04311-820

DATE	TEMP (°C)	pH	DO (mg/L)	COND (µmhos/cm)	HARD (mg/L)	ALK (mg/L)	Source	No. of Animals	Water Change	Feeding	Disposition	Comments	Init.
10-17-06	13.6	5.3	8.2	62	26	20	Siletzy River (cellar (v))	~58	yes		Rec'd clark	~33 animals 5 tanks #1-5	UB
10-17-06	-	-	-	-	26	-	Siletzy River (cellar (v))	-	-	-			UB
10-18-06	12.3	7.4	10.7	135	43	50	Siletzy River (cellar (v))	~58	yes	-		Tank #1 w/9 holding tanks #3, 4, 5	af
10-18-06	12.4	6.0	9.6	95	26	20	"	~255		-	Rec'd clark		64
10-19-06	12.5	7.1	10.8	133	51	60	"	~313	yes	-	16 tank #4 ad tank #9	tank #1 holding w/9 tank #5 holding w/9	af
10-20-06	12.7	7.5	10.6	120	51	30	"	"	yes	-		tank #8 holding w/9	GH
10-21-06	12.5	7.5	11.1	130	43	30	"	"	yes	-		Tk #2 w/9	GH
10-22-06	12.2	7.1	10.9	125	51	60	"	"	"	-			af
10-23-06	12.6	6.9	10.8	120	51	30	"	"	"	-	removed 1 dead Tk #4	Tk #4 w/9	af
10-23-06	11.5	6.8	8.4	75	24	20	Siletzy River (cellar (v))	~782		-	Rec'd clark	~50 in Tanks 10, 11, 12, 13	UB
10-24-06	12.3	7.4	10.8	130	51	50	"	2500	"	-		Tank #12 w/9	af
10-24-06	10.6	6.0	8.4	150	51	90	"		"	-	Rec'd clark	~45 in Tanks 10, 11, 12, 13, 14	GH
10-25-06	12.4	6.9	10.8	130	43	30	"	"	"	-	16 tank 14	tank #14 w/9	GH
10-26-06	12.6	7.4	10.6	130	43	50	"	"	"	-		Tank #12 w/9	GH
10-27-06	12.4	7.0	10.8	130	43	50	"	"	"	-	16 tank 18	Tank #17 w/9	GH
10-28-06	12.4	7.1	10.8	130	43	40	"	"	"	-		Tank #3 w/9	af
10-29-06	12.4	8.1	10.8	135	51	50	"	"	"	-		Tank #11 w/9	GH
10-30-06	12.7	8.0	10.4	130	43	50	"	"	"	-		Tank #15 w/9	GH
10-31-06	12.8	7.8	10.2	130	43	40	"	"	"	-		Tk #19 w/9	UB
11-1-06	12.6	7.9	10.3	135	43	40	"	"	"	-	235 animals sent for F	Tk #14	UB

\* Held in Flowthrough tanks



## ANIMAL RECEIPT/HOLDING: FRESHWATER

SPECIES: Lampetra tridentata (Pacific Lamprey)sp. emb 11-82

DATE	TEMP (°C)	pH	DO (mg/L)	COND (µmhos/cm)	HARD (mg/L)	ALK (mg/L)	Source	No. of Animals	Water Change	Feeding	Disposition	Comments	Init.
11-2-82	12-1	8.2	10.3	330	51	50	57/4th River P. 2nd Creek	2750	4/2	—		TANK #6 NH <sub>3</sub> TAKEN	CS
11-3-82	11.8	7.9	10.8	130	51	40	"	"	"	—		Tank #9 NH <sub>3</sub> taken	GH
11-4-82	11.2	8.0	11.6	130	51	40	"	"	"	—		Tank #13 NH <sub>3</sub> taken	GH
11-5-82	11.6	7.9	11.2	135	51	50	"	2900	"	—		TANK #16 NH <sub>3</sub> taken	GH
11-6-82	13.2	7.9	13.0	119	51	30	"	"	"	—		TANK #1 NH <sub>3</sub> TAKEN	LPS
11-7-82	11.9	7.7	11.4	130	51	50	"	"	"	—		Tank #11 NH <sub>3</sub> taken	GH
11-8-82	11.5	8.0	11.2	125	51	50	"	"	"	—		TANK #17 NH <sub>3</sub> TAKEN	CS
11-9-82	11.8	8.0	11.3	125	51	40	"	"	"	—	used ~ 100 animals for bath	TANK #4 NH <sub>3</sub> TAKEN	CS
11-10-82	11.7	7.9	11.2	115	43	50	"	2650	"	—		TANK #16 NH <sub>3</sub> TAKEN	GH/LP
11-11-82	11.2	7.7	11.1	120	51	40	"	"	"	—		TANK #1 NH <sub>3</sub> TAKEN	CS
11-12-82	11.3	7.8	11.0	130	51	40	"	"	"	—		TANK #13 NH <sub>3</sub> TAKEN	CS
11-13-82	11.4	7.6	11.0	130	51	40	"	"	"	—		TANK #15 NH <sub>3</sub> TAKEN	GH
11-14-82	11.6	7.5	10.9	125	51	40	"	"	"	—		Tank #14 NH <sub>3</sub> taken	GH
11-15-82	11.8	7.6	10.9	132	51	40	"	"	"	—		TANK #12 NH <sub>3</sub> TAKEN	LPS
11-16-82	11.4	7.4	11.1	130	43	50	"	"	"	—		TANK #14 NH <sub>3</sub> TAKEN	GH
11-17-82	11.6	7.6	11.3	117	51	40	"	"	"	—		TANK #1 NH <sub>3</sub> TAKEN	LPS/CS
11-18-82	11.8	7.4	11.2	120	51	40	"	"	"	—		TANK #1 NH <sub>3</sub> TAKEN	CS
11-20-82	11.9	7.3	11.4	110	51	40	"	"	"	—		TANK #13 NH <sub>3</sub> TAKEN	CS
11-21-82	—	—	—	—	—	—	"	"	"	—	Flowfully 25 oil tanks feed	25 dry feed	CS
11-22-82	11.4	7.2	11.2	125	51	50	"	"	"	—		TANK #15 NH <sub>3</sub> TAKEN	LPS

# ANIMAL RECEIPT/HOLDING; FRESHWATER—temperature acclimation study

120L

SPECIES: Lampetra sp.

DATE	TEMP (°C)	pH	DO (mg/L)	COND (µmhos/cm)	HARD (mg/L)	ALK (mg/L)	Source	No. of Animals	Water Change	Feeding	Disposition	Comments	Init.
11-24-06	11.6	7.4	11.6	120	51	40	Siletty River		yes			TANK #14 NH <sub>3</sub> -N 5 TAKEN	631
11-25-06	12.0	7.6	11.3	135	60	50	"		yes			TANK #19 NH <sub>3</sub> -N TAKEN	632
11-26-06	11.9	7.6	11.2	140	60	50	"		"			TANK #18 NH <sub>3</sub> -N TAKEN	631
11-27-06	11.6	7.3	11.2	140	51	30	"		"			TANK #12 NH <sub>3</sub> -N TAKEN	634
11-28-06	11.6	7.5	11.2	150	60	50	"		"			TANK #19 NH <sub>3</sub> -N TAKEN	631
11-29-06	11.3	7.4	11.2	140	51	50	"		"			TANK #14 NH <sub>3</sub> -N TAKEN	634
11-30-06	11.7	7.5	11.0	135	60	40	"		"			TANK #18 NH <sub>3</sub> -N TAKEN	631
12-1-06	11.8	7.4	11.4	130	60	40	"		"			TANK #12 NH <sub>3</sub> -N TAKEN	634
12-2-06	11.9	7.3	11.2	130	51	40	"		"			TANK #13 NH <sub>3</sub> -N TAKEN	634
12-3-06	11.8	7.0	10.4	145	51	30	"		"			TANK #16 NH <sub>3</sub> -N TAKEN	634
12-4-06	11.4	7.3	10.6	140	60	40	"		"			TANK #14 NH <sub>3</sub> -N TAKEN	632
12-5-06	12.0	6.9	11.2	140	51	40	"		"			TANK #12 NH <sub>3</sub> -N TAKEN	635
12-6-06	12.2	7.3	10.7	125	60	40	"		"			TANK #12 NH <sub>3</sub> -N TAKEN	635
12-7-06	12.0	7.4	10.9	135	60	40	"		"			TANK #13 NH <sub>3</sub> -N TAKEN	631
12-8-06	12.2	7.4	11.0	120	51	40	"		"			TANK #14 NH <sub>3</sub> -N TAKEN	631



## 222

SPECIES: Lampetra sp.

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Tank #1 lampreys  
(first Batch)

L (cm)	W (g)
1. 8.4 (cm)	0.78g
2. 8.1 (cm)	0.78g
3. 5.1 (cm)	0.17
4. 4.5 (cm)	0.15
5. 3.0 (cm)	0.06
6. 2.8 (cm)	0.04

wrote wrong units  
GH 2-15-07

10-23-06

GH

Initial representative  
subsample upon  
lab receipt

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS – CHEMICAL TESTS**

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-31 <sup>0405 11-16-06</sup> Client Windward Investigator \_\_\_\_\_

## STUDY MANAGEMENT:

Client: Windward Environmental, 200 West Mercer Street, Suite 401, Seattle, WA 98119

Client's Study Monitor: Ms. Helle Anderson

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Project Manager/Study Director: G.A. Buhler

QA Officer: L.K. Nemeth

2. P.S. Caldwell

4. \_\_\_\_\_

1. G.J. IRISSARRI 651

3. \_\_\_\_\_

5. \_\_\_\_\_

Study Schedule:

Test Beginning: 11-9-06 1820 Test Ending: 11-13-06 1720

## TEST MATERIAL:

Description: Aniline Fisher Scientific Lot # 062904 (purity: 99.9% assay)

NAS Sample No.: \_\_\_\_\_

Date of Preparation: \_\_\_\_\_

## DILUTION WATER:

Description: City of Newport tap water

Date of Preparation/Collection: 11-9-06\*

Water Quality: Cond. (µmhos/cm) 110 pH 7.2

Hardness (mg/L as CaCO<sub>3</sub>) 51 Alkalinity (mg/L as CaCO<sub>3</sub>) 40

Total Chlorine (mg/L, DL 0.02 mg/L) 10.02

Treatments: Dechlorinated, aerated ≥ 24 hours

\* Tank of dilution water was prepared before lampreys were received in the lab, topped off daily when needed, and constantly aerated. Dilut. on water needed for test was removed on 11-9-06.

## TEST ORGANISMS:

Species: Lampetra sp. Age/Size: 9 mmoloches

Source: Siletz River, Oregon—Cedar Creek area

Acclimation Data:

Date	Temp. (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	Total Ammonia-N (mg/L)	Comments (including tank #)
10-26-06	12.6	7.4	10.6	130	43	50	0.00	#2
10-27-06	12.4	7.0	11.2	130	43	50	0.00	#17
10-28-06	12.4	7.1	10.8	130	43	40	0.00	#3
10-29-06	12.9	8.1	10.8	135	43.5	50	0.01	#11
10-30-06	12.7	8.0	10.4	130	43	50	0.01	#5
10-31-06	12.8	7.8	10.2	130	43	40	0.01	#19
11-1-06	12.6	7.9	10.3	135	43	40	0.00	#14
11-2-06	12.1	8.2	10.3	130	51	50	0.00	#6
11-3-06	11.8	7.9	10.8	130	51	40	0.00	#9
11-4-06	11.2	8.0	11.6	130	51	40	0.00	#13
11-5-06	11.6	7.9	11.2	135	51	50	0.00	#16
11-6-06	13.2	7.9	13.0	120	51	30	0.00	#1
11-7-06	11.9	7.7	11.4	130	51	50	0.01	#11
11-8-06	11.5	8.0	11.2	125	51	50	0.01	#17
11-9-06	11.8	8.0	11.3	125	51	40	0.00	#4
Mean	12.2	7.8	11.0	130	48	45	0.00	
S.D.	0.6	0.4	0.7	0.4	4	6	0.00	
(N)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-X <sup>310</sup> <sup>08/11/06</sup> Client Windward Investigator

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 1,000, 100, 10, 1.0 and 0 mg/L (control). All concentrations are nominal.

Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lids

Test Volume (mL): 2.8 L Replicates/treatment: 1

Organisms/treatment: 5 (5/repl) Temperature (°C) 12 ± 1

Test water changes: one, at 48 hours Aeration during test: Yes

Feeding: None Test Duration: 96 hr

Photoperiod (L/D): 16/8 Light intensity (ft.c.): 65-4 11-10-06 6A3

Beaker Placement: Stratified randomization

Randomization chart:

Location: Room 1

<u>0</u>	<u>100</u>	<u>1000</u>	<u>1-0</u>	<u>10</u>	
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## STOCK SOLUTION PREPARATION:

## TEST SOLUTION PREPARATION:

3.7 mL of aniline stock is diluted to 3,700 mL; this is the 1,000 mg/L concentration.  
370 mL of this is then diluted to 3,700 mL; this is the 100 mg/L concentration.  
This process is repeated for the 10 and 1.0 mg/L concentration.

After all solutions are mixed, 500 mL is removed for chemistry samples.

## LOADING (g/L):

(weigh and measure length of controls at end of test)

Length (mm)	Weight (g)
<u>72</u>	<u>0.49</u>
<u>67</u>	<u>0.38</u>
<u>71</u>	<u>0.47</u>
<u>79</u>	<u>0.63</u>
<u>83</u>	<u>0.75</u>

74  
6  
(15)

0.54  
0.15  
(5)

$$0.54 \text{ g/fish} \times 5 \text{ fish} \div 2.8 \text{ L} = 0.96 \text{ g/L}$$



## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-131 <sup>04/11/06</sup> Client Windward Investigator

## WATER QUALITY DATA SHEET

DAY 0 (11/9/06) <sup>05/63</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1,000	12.8	7.6	10.5	120	51	440	5	All fish L quiescent
100	12.8	7.4	10.4				5	
10	12.9	7.4	10.4				5	
1.0	12.8	7.2	10.5				5	
Control	12.8	7.2	10.4	110	51	40	5	

NOTES: Sample new solutions at each concentration and ship to CAS.

DAY 1 (11/10/06) <sup>05</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1,000	12.4	7.4	10.3				5	All fish quiescent
100	12.4	7.4	10.2				5	
10	12.3	7.4	10.4				5	
1.0	12.4	7.3	10.3				5	
Control	12.3	7.2	10.2				5	

DAY 2 (11/11/06) <sup>05</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1,000	12.6	7.5	10.4	125	51	460	2 (30)	All surviving fish quiescent
100	12.5	7.4	10.6				5	
10	12.4	7.4	10.6				5	
1.0	12.5	7.3	10.6				5	
Control	12.4	7.3	10.6	120	51	40	5	

NOTES: Sample new and old solutions at each concentration and ship to CAS.

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-4 <sup>31 03 11-16-24</sup> Client Windward Investigator \_\_\_\_\_

## WATER QUALITY DATA SHEET

DAY 3 (11/12/06) 632/102

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1,000	12.8	7.6	10.4				2	Resistant
100	12.8	7.5	10.2				5	
10	12.6	7.4	9.9				5	
1.0	12.8	7.5	10.1				5	
Control	12.9	7.5	10.2				5	

DAY 4 (11/13/06) 633

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1,000	12.5	7.5	10.2	125	51	440	0/20	
100	12.6	7.3	10.1				5	103 mg/L, 115 wt % solution Fluoride
10	12.3	7.3	10.3				5	normal
1.0	12.5	7.2	10.2				5	
Control	12.4	7.2	10.2	120	51	40	5	

NOTES: Sample old solutions at each concentration and ship to CAS. Weigh and measure lengths on control animals.

WQ:

$\bar{X}$	12.6	7.4	10.3	120	51	1000	40
SD	0.2	0.1	0.2	5	0	12	0
(N)	(25)	(25)	(25)	(6)	(6)	(3)	(3)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-<sup>31</sup>~~4~~<sup>11-16-06</sup>

Client

Windward

Investigator

## WATER SAMPLING RECORD

NAS Sample #	Description Day	Conc. (mg/L)	Date	Time	Initials	Comments
07906	Day 0	1,000	11-9-06	1545	MB	500mL
07916	Day 0	100	↓	↓	↓	↓
07926	Day 0	10	↓	↓	↓	↓
07936	Day 0	1.0	↓	↓	↓	800mL
07946	Day 0	control	↓	↓	↓	1,000mL
08256	Day 2-old	1,000	11-11-06	1645	MB	1,000mL
08266	Day 2-old	100	↓	↓	↓	↓
08276	Day 2-old	10	↓	↓	↓	↓
08286	Day 2-old	1.0	↓	↓	↓	↓
08296	Day 2-old	control	↓	↓	↓	↓
08306	Day 2-new	1,000	11-11-06	1610	MB	500mL
08316	Day 2-new	100	↓	↓	↓	↓
08326	Day 2-new	10	↓	↓	↓	↓
08336	Day 2-new	1.0	↓	↓	↓	800mL
08346	Day 2-new	control	↓	↓	↓	1,000mL
08506	Day 4	1,000	11-13-06	1720	MB	1,000mL
08516	Day 4	100	↓	↓	↓	↓
08526	Day 4	10	↓	↓	↓	↓
08536	Day 4	1.0	↓	↓	↓	↓
08546	Day 4	control	↓	↓	↓	↓

Copper

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-2 Client 320 413/11202 Woodward Investigator \_\_\_\_\_

## STUDY MANAGEMENT:

Client: Woodward Environmental, 200 West Mercer Street, Suite 401, Seattle, WA 98119Client's Study Monitor: Ms. Helle AndersonTesting Laboratory: Northwestern Aquatic SciencesTest Location: Newport Laboratory

Laboratory's Study Personnel:

Project Manager/Study Director: G.A. Buhler *643*QA Officer: L.K. Nemeth2. V.S. Caldwell *682*

4. \_\_\_\_\_

1. G.J. RISSARRI *632*

3. \_\_\_\_\_

5. \_\_\_\_\_

Study Schedule:

Test Beginning: 11-9-06 1700Test Ending: 1620

## TEST MATERIAL:

Description: Copper as CuSO<sub>4</sub>•5H<sub>2</sub>O, Argent Lot No. 0195. 1mg/mL stock prepared 10-27-05.NAS Sample No.: 1 only 99% minimum

Date of Preparation: \_\_\_\_\_

## DILUTION WATER:

Description: City of Newport tap waterDate of Preparation/Collection: 11-9-06\*Water Quality: Cond. (µmhos/cm) 110pH 7.2Hardness (mg/L as CaCO<sub>3</sub>) 51Alkalinity (mg/L as CaCO<sub>3</sub>) 40Total Chlorine (mg/L, DL 0.02 mg/L) 10.02Treatments: Dechlorinated, aerated ≥ 24 hours

\* Tank of dilution water was prepared before lampreys were received in the lab, topped off daily when needed, and constantly aerated. Dilution water needed for test was removed on 11-9-06.

## TEST ORGANISMS:

Species: Lampetra sp.Age/Size: ammocoetesSource: Siletz River, Oregon—Cedar Creek area

Acclimation Data:

Date	Temp. (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	Total Ammonia-N (mg/L)	Comments (including tank #)
10-26-06	12.6	7.4	10.6	130	43	50		#2
10-27-06	12.4	7.0	11.2	130	43	50		#17
10-28-06	12.4	7.1	10.8	130	43	40		#3
10-29-06	12.9	8.1	10.8	135	51	50		#11
10-30-06	12.7	8.0	10.4	130	43	50		#5
10-31-06	12.8	7.8	10.2	130	43	40		#19
11-1-06	12.6	7.9	10.3	135	43	40		#14
11-2-06	12.1	8.2	10.3	130	51	50		#6
11-3-06	11.8	7.9	10.8	130	51	40		#9
11-4-06	11.2	8.0	11.6	130	51	40		#13
11-5-06	11.6	7.9	11.2	135	51	50		#16
11-6-06	13.2	7.9	13.0	120	51	30		#1
11-7-06	11.9	7.7	11.4	130	51	50		#11
11-8-06	11.5	8.0	11.2	125	51	50		#17
11-9-06	11.8	8.0	11.3	125	51	40		#4
Mean	12.2	7.8	11.0	130	48	45		
S.D.	0.6	0.4	0.7	0.4	4	6		
(N)	(15)	(15)	(15)	(15)	(15)	(15)		

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-2 Client 32 October 20 Windward \_\_\_\_\_ Investigator \_\_\_\_\_

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 1.0, 0.1, 0.01, 0.001 and 0 mg/L (control)  
 Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lids  
 Test Volume (mL): 2.8 L Replicates/treatment: 1  
 Organisms/treatment: 5 (5/repl) Temperature (°C): 12 ± 1  
 Test water changes: one, at 48 hours Aeration during test: Yes  
 Feeding: None Test Duration: 96 hr  
 Photoperiod (L/D): 16/8 Light intensity (ft.c.): 64.5 11-10-06 AB  
 Beaker Placement: Stratified randomization

Randomization chart:

Location: Room 1

0.001	1.0	∅	0.01	0.1	
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## STOCK SOLUTION PREPARATION:

## TEST SOLUTION PREPARATION:

3.7 mL of 1mg/mL copper stock is diluted to 3,700 mL; this is the 1.0 mg/L concentration.  
 370 mL of this is then diluted to 3,700 mL; this is the 0.1 mg/L concentration.  
 This process is repeated for the 0.01 and 0.001 mg/L concentration.

After all solutions are mixed, 500 mL is removed for chemistry samples.

## LOADING (g/L):

(weigh and measure length of controls at end of test)

Length (mm)	Weight (g)
55	0.25
51	0.19
50	0.19
56	0.24
58	0.42

X  
SD  
(N)

54	0.26
3	0.09
(15)	(15)

$$0.26 \text{ g/fish} \times 5 \text{ fish} \div 2.8 \text{ L} = 0.46 \text{ g/L}$$

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-2 <sup>32048116-04</sup> Client Windward Investigator                     

## WATER QUALITY DATA SHEET

DAY 0 (11/9/06) <sup>686/631</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1.0	12.2	6.9	10.8	110	51	40	5	
0.1	12.1	7.1	10.8				5	
0.01	12.2	7.1	10.7				5	
0.001	12.1	7.1	10.8				5	
Control	12.3	7.1	10.6	116	51	40	5	

NOTES: Sample new solutions at each concentration and ship to CAS.

DAY 1 (11/10/06) <sup>686</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1.0	12.2	7.2	10.6				0 (50)	
0.1	12.3	7.2	10.4				5	
0.01	12.3	7.2	10.2				5	
0.001	12.4	7.2	10.5				5	
Control	12.6	7.2	10.3				5	

DAY 2 (11/11/06) <sup>686</sup>

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1.0	12.2	7.3	10.7	120	51	40	0	
0.1	12.3	7.3	10.6				5	ALL fish qui esent
0.01	12.3	7.3	10.6				5	
0.001	12.3	7.3	10.6				5	
Control	12.6	7.3	10.4	115	51	40	5	

NOTES: Sample new and old solutions at each concentration and ship to CAS.

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-232 <sup>11-16-06</sup> Client Windward Investigator

## WATER QUALITY DATA SHEET

DAY 3 (11/12/06) 652 / 17.2

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1.0	12.7	7.5	10.4				—	
0.1	12.7	7.6	10.3				5	3 present
0.01	12.8	7.6	10.5				5	
0.001	12.6	7.6	10.4				5	
Control	12.8	7.6	10.4				5	

DAY 4 (11/13/06) 113

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
1.0	12.1	7.3	10.5	115	51	40	0	
0.1	12.1	7.3	10.3				2 (30)	quiescent, light disturbed
0.01	12.1	7.2	10.4				5	normal
0.001	12.1	7.2	10.3				5	
Control	12.1	7.2	10.2	110	51	40	5	↓

NOTES: Sample old solutions at each concentration and ship to CAS. Weigh and measure lengths on control animals.

WQ:  $\bar{x}$  12.3 7.3 10.5 113 51 40  
 SD 0.2 0.2 0.2 4 0 0  
 (N) (25) (25) (25) (6) (6) (6)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-2<sup>32</sup> <sup>03 11/16/06</sup>

Client

Windward

Investigator

Copy

## WATER SAMPLING RECORD

NAS Sample #	Description Day Conc. (mg/L)	Date	Time	Initials	Comments
07756	Day 0 1.0	11-9-06	1400	GAZ	500mL
07766	Day 0 0.1	↓	↓	↓	↓
07776	Day 0 0.01	↓	↓	↓	↓
07786	Day 0 0.001	↓	↓	↓	↓
07796	Day 0 control	↓	↓	↓	↓
07956	Day 2-old 1.0	11-11-06	1545	GAZ	500mL
07966	Day 2-old 0.1	↓	↓	↓	↓
07976	Day 2-old 0.01	↓	↓	↓	↓
07986	Day 2-old 0.001	↓	↓	↓	↓
07996	Day 2-old control	↓	↓	↓	↓
08006	Day 2-new 1.0	11-11-06	1545	GAZ	500mL
08016	Day 2-new 0.1	↓	↓	↓	↓
08026	Day 2-new 0.01	↓	↓	↓	↓
08036	Day 2-new 0.001	↓	↓	↓	↓
08046	Day 2-new control	↓	↓	↓	↓
08356	Day 4 1.0	11-13-06	1620	GAZ	500mL
08366	Day 4 0.1	↓	↓	↓	↓
08376	Day 4 0.01	↓	↓	↓	↓
08386	Day 4 0.001	↓	↓	↓	↓
08396	Day 4 control	↓	↓	↓	↓



### STUDY MANAGEMENT:

Project Manager/Study Director: G.A. Buhler <sup>RD</sup>  
QA Officer: L.K. Nemeth  
2. R.S. Caldwell <sup>RD</sup>  
4.   
1. G.J. IRISSARRI <sup>GSJ</sup>  
3.   
5.

**TEST MATERIAL:**

Description: Pentachlorophenol (PCP) Eastman Organic Chemicals

NAS Sample No.: \_\_\_\_\_

Date of Preparation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Description: City of Newport tap water  
Date of Preparation/Collection: 11-9-06 \*  
Water Quality: Cond. ( $\mu\text{mhos/cm}$ ) 110 pH 7.2  
Hardness ( $\text{mg/L as CaCO}_3$ ) 51 Alkalinity ( $\text{mg/L as CaCO}_3$ ) 40  
Total Chlorine ( $\text{mg/L, DL 0.02 mg/L}$ ) 20-02  
Treatments: Dechlorinated, aerated  $\geq 24$  hours

\* Tank of dilution water was prepared before lampreys were received in lab, topped off daily when needed, and constantly aerated. Dilution water needed for test was removed on 11-9-06.

**TEST ORGANISMS:**

Species: Lampetra sp. Age/Size: 9 mm larvae  
Source: Siletz River, Oregon—Cedar Creek area  
Acclimation Data: See holding data

[illegible]

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-3 <sup>33 0 011-10-06</sup> Client Windward Investigator                     

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 4.0, 0.4, 0.04, 0.004 and 0 mg/L (control). All concentrations are nominal.

Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lids

Test Volume (mL): 2.8 L Replicates/treatment: 1

Organisms/treatment: 5 (5/repl) Temperature (°C) 12 ± 1

Test water changes: one, at 48 hours Aeration during test: Yes

Feeding: None

Photoperiod (L/D): 16/8 Light intensity (ft.c.): 68.9 11-10-06 v3

Beaker Placement: Stratified randomization

Randomization chart:

Location: Room 1

0.4	0.004	0	0.04	4.0	
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## STOCK SOLUTION PREPARATION:

## TEST SOLUTION PREPARATION:

370 mL of 40 mg/mL PCP stock is diluted to 3,700 mL; this is the 4.0 mg/L concentration.

370 mL of this is then diluted to 3,700 mL; this is the 0.4 mg/L concentration.

This process is repeated for the 0.04 and 0.004 mg/L concentration.

After all solutions are mixed, 500 mL is removed for chemistry samples.

## LOADING (g/L):

(weigh and measure length of controls at end of test)

Length (mm)	Weight (g)
55	0.25
51	0.18
50	0.15
49	0.17
P2	0.66

$$0.28 \text{ g/fish} \times 5 \text{ fish} = 2.8 \text{ g} = 0.38 \text{ g/L}$$

61  
CALCULATION  
ERROR 2-19-07

7  
SD  
(N)

57	0.28
14	0.21
15	15)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-33 <sup>0114620</sup> Client Windward Investigator

## WATER QUALITY DATA SHEET

DAY 0 (11/9/06) MS/631

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
4.0	12.2	7.2	10.4	115	51	40	5	All fish quiescent
0.4	12.2	7.1	10.4				5	
0.04	12.2	7.1	10.2				5	
0.004	12.2	7.1	10.4				5	
Control	12.3	7.1	10.4	110	51	40	5	

NOTES: Sample new solutions at each concentration and ship to CAS.

DAY 1 (11/10/06) MS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
4.0	12.2	7.4	10.2				0(50)	
0.4	12.2	7.3	10.4				0(50)	
0.04	12.2	7.3	10.4				5	
0.004	12.2	7.2	10.2				5	
Control	12.2	7.2	10.3				5	

DAY 2 (11/11/06) MS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
4.0	12.2	7.5	10.5	125	51	40	0	
0.4	12.2	7.4	10.5				0	
0.04	12.2	7.3	10.4				5	
0.004	12.3	7.3	10.4				5	
Control	12.3	7.3	10.5	120	51	40	5	

NOTES: Sample new and old solutions at each concentration and ship to CAS.

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-330 11-16-00 Client Windward Investigator

## WATER QUALITY DATA SHEET

DAY 3 (11/12/00) 632/182/

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
4.0	12.7	7.6	10.3				0	
0.4	12.7	7.6	10.4				0	
0.04	12.7	7.6	10.2				5	
0.004	12.8	7.6	10.3				5	
Control	12.8	7.5	10.2				5	

DAY 4 (11/13/00) 103

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
4.0	12.1	7.3	10.6	115	51	40	0	
0.4	12.1	7.3	10.6			40	0	
0.04	12.1	7.3	10.5				5	normal
0.004	12.1	7.2	10.4				5	
Control	12.1	7.2	10.4	115	51	40	5	

NOTES: Sample old solutions at each concentration and ship to CAS. Weigh and measure lengths on control animals.

WR  
X  
SD  
(14)

12.3 7.3 10.4 117 51 40  
0.2 0.2 0.1 5 0 0  
(15) (25) (25) (6) (6) (6)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-2 <sup>33048, 176-06</sup> Client Windward Investigator

## WATER SAMPLING RECORD

NAS Sample #	Description Day Conc. (mg/L)	Date	Time	Initials	Comments
07806	Day 0 4.0	11-9-06	1415	GAZ	500mL
07816	Day 0 0.4	↓	↓	↓	↓
07826	Day 0 0.04	↓	↓	↓	↓
07836	Day 0 0.004	↓	↓	↓	800mL
07846	Day 0 control	↓	↓	↓	1,000mL
08056	Day 2-old 4.0	11-11-06	1625	GAZ	1,000mL
08066	Day 2-old 0.4	↓	↓	↓	↓
08076	Day 2-old 0.04	↓	↓	↓	↓
08086	Day 2-old 0.004	↓	↓	↓	↓
08096	Day 2-old control	↓	↓	↓	↓
08106	Day 2-new 4.0	11-11-06	1555	GAZ	500mL
08116	Day 2-new 0.4	↓	↓	↓	↓
081126	Day 2-new 0.04	↓	↓	↓	↓
081136	Day 2-new 0.004	↓	↓	↓	800mL
081146	Day 2-new control	↓	↓	↓	1,000mL
08406	Day 4 4.0	11-13-06	1650	GAZ	1,000mL
08416	Day 4 0.4	↓	↓	↓	↓
08426	Day 4 0.04	↓	↓	↓	↓
08436	Day 4 0.004	↓	↓	↓	↓
08446	Day 4 control	↓	↓	↓	↓

*Laden*

### STUDY MANAGEMENT:

Laboratory's Study Personnel:

Project Manager/Study Director: <u>G.A. Buhler</u>	1. <u>G.J. IRISSARI</u>
QA Officer: <u>L.K. Nemeth</u>	3. _____
<u>P.S. Caldwell</u>	5. _____
4. _____	

**TEST MATERIAL:**

**DILUTION WATER:**

**Treatments:** Dechlorinated, aerated  $\geq 24$  hours

Treatments: Dechlorinated, aerated  $\geq 24$  hours  
\*Tank of dilution water was prepared before lampreys were received in lab, topped off daily when needed, and constantly aerated. Dilution water needed for test was removed on 11-9-06.

**TEST ORGANISMS:**

Source: Siletz River, Oregon—Cedar Creek area

Acclimation Data: see holding cluster

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## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-4 <sup>34 02/11/06</sup> Client \_\_\_\_\_ Windward \_\_\_\_\_ Investigator \_\_\_\_\_

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 8.0, 0.8, 0.08, 0.008 and 0 mg/L (control) All concentrations are nominal.

Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lids

Test Volume (mL): 2.8 L Replicates/treatment: 1

Organisms/treatment: 5 (5/repl) Temperature (°C) 12 ± 1

Test water changes: one, at 48 hours Aeration during test: Yes

Feeding: None Test Duration: 96 hr

Photoperiod (L/D): 16/8 Light intensity (ft.c.): 534 11-10-06 413

Beaker Placement: Stratified randomization

Randomization chart:

Location: Room 1

8.0	0	0.8	0.08	0.008	
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## STOCK SOLUTION PREPARATION:

## TEST SOLUTION PREPARATION:

Stock lindane solution is the 8.0 mg/L test concentration.

370 mL of 8 mg/L lindane is then diluted to 3,700 mL this is the 0.8 mg/L concentration.

This process is repeated for the 0.08 and 0.008 mg/L concentration.

After all solutions are mixed, 500 mL is removed for chemistry samples.

## LOADING (g/L):

(weigh and measure length of controls at end of test)

Length (mm)	Weight (g)
59	0.27
58	0.27
68	0.37
70	0.43
88	0.79

$$0.43 \text{ g/fish} \times 5 \text{ fish} \div 2.8 \text{ L} = 0.77$$

$\bar{X}$   
SD  
(N)

69  
12  
(15)

0.43  
0.21  
(15)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-4<sup>34</sup> Client <sup>11-1600</sup> Windward Investigator

## WATER QUALITY DATA SHEET

DAY 0 (11/9/06) MS/651

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
8.0	12.2	7.3	10.4	115	51	40	5	ALL Fish quiescent
0.8	12.2	7.3	10.2				5	
0.08	12.3	7.2	10.2				5	
0.008	12.1	7.2	10.4				5	
Control	12.2	7.2	10.2	115	51	40	5	

NOTES: Sample new solutions at each concentration and ship to CAS.

DAY 1 (11/10/06) MS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
8.0	12.1	7.5	10.1				0(50)	
0.8	12.1	7.4	10.2				5	ALL Fish quiescent
0.08	12.2	7.3	10.5				5	
0.008	12.2	7.3	10.2				5	
Control	12.1	7.3	10.4				5	

DAY 2 (11/11/06) MS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
8.0	12.2	7.5	10.4	120	51	40	0	
0.8	12.2	7.4	10.5				5	ALL Fish quiescent
0.08	12.2	7.4	10.4				5	
0.008	12.1	7.4	10.8				5	
Control	12.2	7.3	10.6	120	51	40	5	

NOTES: Sample new and old solutions at each concentration and ship to CAS.



## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-434 <sup>08/11/06</sup> Client \_\_\_\_\_ Windward \_\_\_\_\_ Investigator \_\_\_\_\_

## WATER QUALITY DATA SHEET

DAY 3 (11/12/06) 622/JS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
8.0	12.7	7.6	10.4				0	
0.8	12.6	7.6	10.2				5	all gills out
0.08	12.8	7.6	10.3				5	
0.008	12.8	7.5	10.3				5	
Control	12.6	7.5	10.4				5	

DAY 4 (11/13/06) 622/JS

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
8.0	12.1	7.4	10.3	115	51	40	0	
0.8	12.2	7.3	10.2				5	twisting, kidney, body, sweating mucus
0.08	12.2	7.3	10.4				5	2 normal, 3 erratic
0.008	12.3	7.3	10.3				5	normal
Control	12.1	7.2	10.2	115	51	40	5	↓

NOTES: Sample old solutions at each concentration and ship to CAS. Weigh and measure lengths on control animals.

10 =  
X  
SD  
(N)

12.3 7.4 10.3 117 51 40  
0.2 0.1 0.2 3 0 0  
(25) (25) (25) (6) (6) (6)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-434 <sup>040117620</sup> Client Windward Investigator

## WATER SAMPLING RECORD

NAS Sample #	Description Day Conc. (mg/L)	Date	Time	Initials	Comments
07856	Day 0 8.0	11-9-06	1440	GAZ	500 mL
07866	Day 0 0.8	↓	↓	↓	↓
07876	Day 0 0.08	↓	↓	↓	↓
07886	Day 0 0.008	↓	↓	↓	800 mL
07896	Day 0 control	↓	↓	↓	1,000 mL
08156	Day 2-old 8.0	11-11-06	1635	GAZ	1,000 mL
08166	Day 2-old 0.8	↓	↓	↓	↓
08176	Day 2-old 0.08	↓	↓	↓	↓
08186	Day 2-old 0.008	↓	↓	↓	↓
08196	Day 2-old control	↓	↓	↓	↓
08206	Day 2-new 8.0	11-11-06	1600	GAZ	500 mL
08216	Day 2-new 0.8	↓	↓	↓	↓
08226	Day 2-new 0.08	↓	↓	↓	↓
08236	Day 2-new 0.008	↓	↓	↓	800 mL
08246	Day 2-new control	↓	↓	↓	1,000 mL
08456	Day 4 8.0	11-13-06	1710	GAZ	1000 mL
08466	Day 4 0.8	↓	↓	↓	↓
08476	Day 4 0.08	↓	↓	↓	↓
08486	Day 4 0.008	↓	↓	↓	↓
08496	Day 4 control	↓	↓	↓	↓

Test No. 686-35      Client Windward      Investigator \_\_\_\_\_

Client: Windward Environmental, 200 West Mercer Street, Suite 401, Seattle, WA 98119

Client's Study Monitor: Ms. Helle Andersen

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

### Laboratory's Study Personnel:

Project Manager/Study Director: G.A. Buhler <sup>415</sup>

QA Officer: L.K. Nemeth

2.

4.

**Study Schedule:**

Test Beginning: 11-16-26 1445 Test Ending: 11-20-26 1500

Description: Diazinon Chem Service Lot #362-71A (purity 98.22)

NAS Sample No.:

Date of Preparation:

100

Description: City of Newport tap water

Date of Preparation/Collection:

Water Quality: Cond. ( $\mu\text{mhos/cm}$ ) 110

Hardness (mg/L as  $\text{CaCO}_3$ )

Total Chlorine (mg/L, DL 0.02 mg/L)

Treatments: Dechlorinated, aerated  $\geq 24$  hours

\* Tank of dilution water was prepared before bioassays were received in the lab, topped off daily when needed, and constantly aerated. Dilution water needed for test was removed on 11-16-06

**TEST ORGANISMS:**

Species: *Lampetra* sp.

Age/Size: ammonites

Source: Siletz River, Oregon—Cedar Creek area

Acclimation Data: *See holiday data*

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Revised 11/8/06

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-35 Client Windward Investigator                     

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 40, 4.0, 0.4, 0.04 and 0 mg/L (control) All concentrations are nominal.Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lidsTest Volume (mL): 2.8 L Replicates/treatment: 1Organisms/treatment: 5 (5/repl) Temperature (°C) 12 ± 1Test water changes: one, at 48 hours Aeration during test: YesFeeding: None Test Duration: 96 hrPhotoperiod (L/D): 16/8 Light intensity (ft.c.): 64Beaker Placement: Stratified randomization

Randomization chart:

Location: Room 1

0.04	40	Ø	0.4	4.0	
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## STOCK SOLUTION PREPARATION:

## TEST SOLUTION PREPARATION:

Stock diazinon solution is the 40 mg/L test concentration.

370 mL of 40 mg/L diazinon is then diluted to 3,700 mL this is the 4.0 mg/L concentration.

This process is repeated for the 0.4 and 0.04 mg/L concentration.

After all solutions are mixed, 500 mL is removed for chemistry samples.

## LOADING (g/L):

(weigh and measure length of controls at end of test)

Length (mm)	Weight (g)
70	0.41
90	0.90
70	0.38
74	0.53
68	0.40

$\bar{X}$  74 0.52  
SD 9 0.22  
(N) 15 15

$$0.52g \text{ fish} \times 5 \text{ fish} \div 2.8L = 0.93g/L$$

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-35 Client Windward Investigator                     

## WATER QUALITY DATA SHEET

DAY 0 (11/16/06) AB

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
40	12.2	7.3	10.6	115	51	30	5	Tetanus for 2/10, then quiescent
4.0	12.1	7.3	10.6				5	normal
0.4	12.2	7.3	10.5				5	
0.04	12.1	7.3	10.7				5	
Control	12.1	7.3	10.6	115	51	30	5	

NOTES: Sample new solutions at each concentration and ship to CAS.

DAY 1 (11/17/06) B

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
40	11.8	7.1	10.6				5	quiescent
4.0	11.8	7.1	10.5				5	twitching
0.4	11.7	7.1	10.5				5	normal
0.04	11.8	7.1	10.4				5	
Control	11.8	7.1	10.5				5	

DAY 2 (11/18/06) B

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
40	11.9	7.3	10.4	120	51	30	0 (50)	
4.0	12.0	7.3	10.3				5	Tetanus & erratic
0.4	11.9	7.2	10.5				5	
0.04	11.7	7.2	10.6				5	
Control	11.8	7.2	10.6	125	51	30	5	normal

NOTES: Sample new and old solutions at each concentration and ship to CAS.

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-35 Client Windward Investigator                     

## WATER QUALITY DATA SHEET

DAY 3 (11/19/06)

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
40	11.8	7.3	10.6				0	
4.0	11.7	7.3	10.4				5	Twitching & erratic
0.4	11.8	7.3	10.3				5	
0.04	11.8	7.3	10.3				5	↓
Control	11.9	7.3	10.2				5	normal

DAY 4 (11/20/06)

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors	Comments
40	11.9	7.3	10.5	120	51	30	0	
4.0	11.8	7.3	10.6				5	twitching & erratic
0.4	11.8	7.3	10.5				5	
0.04	11.9	7.3	10.3				5	↓
Control	12.0	7.3	10.4	120	51	40	5	normal

NOTES: Sample old solutions at each concentration and ship to CAS. Weigh and measure lengths on control animals.

100%  
 X  
 50  
 (N)

11.9	7.2	10.5	119	51	32
0.1	0.1	0.1	4	0	4
(25)	(25)	(25)	(6)	(6)	(6)

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-35

Client

Windward

Investigator

## WATER SAMPLING RECORD

NAS Sample #	Description	Conc. (mg/L)	Date	Time	Initials	Comments
08556	Day 0	40	11-16-00	1325	UTB	520 mL
08566	Day 0	4.0	↓	↓	↓	↓
08576	Day 0	0.4	↓	↓	↓	↓
08586	Day 0	0.04	↓	↓	↓	820 mL
08596	Day 0	control	↓	↓	↓	1000 mL
08606	Day 2-old	40	11-18-00	1330	UTB	1000 mL
08616	Day 2-old	4.0	↓	↓	↓	↓
08626	Day 2-old	0.4	↓	↓	↓	↓
08636	Day 2-old	0.04	↓	↓	↓	↓
08646	Day 2-old	control	↓	↓	↓	↓
08656	Day 2-new	40	↓	1320	↓	520 mL
08666	Day 2-new	4.0	↓	↓	↓	↓
08676	Day 2-new	0.4	↓	↓	↓	↓
08686	Day 2-new	0.04	↓	↓	↓	820 mL
08696	Day 2-new	control	↓	↓	↓	1000 mL
08706	Day 4	40	11-20-00	1510	UTB	1000 mL
08716	Day 4	4.0	↓	↓	↓	↓
08726	Day 4	0.4	↓	↓	↓	↓
08736	Day 4	0.04	↓	↓	↓	↓
08746	Day 4	control	↓	↓	↓	↓

**TEST DESCRIPTION, MONITORING, AND RESULTS  
BENCHSHEETS – TEMPERATURE TESTS**



Test No. 686-36 Client Windward Investigator \_\_\_\_\_

Test Beginning: 12-106 1500 Test Ending: 12-506 1440

Treatments: Dechlorinated, aerated  $\geq 24$  hours

Acclimation Data: 17°C *see holding data*

Page 32 of 73

Test No. 686-36 Client Windward Investigator \_\_\_\_\_

Acclimation Data: 12°C *See weekly data*

[illegible]

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-36 Client Windward Investigator                     

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 0 (control)

Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lids

Test Volume (mL): 2.8 L Replicates/treatment: 1

Organisms/treatment: 4 (5/repl) Temperature (°C) 12 ± 1 and 17 ± 1

Test water changes: one, at 48 hours Aeration during test: Yes

Feeding: None Test Duration: 96 hr

Photoperiod (L/D): 16/8

Beaker Placement: Stratified randomization

Randomization chart: 17°C Location: Room 3

Light intensity (ft.c.): 73.0 12-1-06

B	A	D	C
---	---	---	---

Randomization chart: 12°C Location: Room 4

Light intensity (ft.c.): 55.6 12-1-06

A	D	C	B
---	---	---	---

## TEST SOLUTION PREPARATION:

2.8 liters of dilution water per tank. 06 12-1-06

## LOADING (g/L):

(weigh and measure length a replicate at end of test)

17°C

Length (mm)	Weight (g)
80	0.72
71	0.46
65	0.47
72	0.55
82	0.78

$\bar{x}$   
(SD)  
(N)  
12°C

74  
7  
(5)

0.59  
0.13  
(5)

$$0.59 \text{ g/fish} \times 5 \text{ Fish} \div 2.8 \text{ L} = 1.05 \text{ g/L}$$

Length (mm)	Weight (g)
98	1.00
72	0.66
60	0.36
69	0.42
46	0.33

$\bar{x}$   
(SD)  
(N)  
NOTES:

66  
15  
(5)

0.55  
0.28  
(5)

$$0.55 \text{ g/fish} \times 5 \text{ Fish} \div 2.8 \text{ L} = 0.98 \text{ g/L}$$

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-36 Client Windward Investigator                     

## WATER QUALITY DATA SHEET

DAY 0 (12/1/06) WM

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
17°C	16.5	7.3	9.7	125	51	30	5	5	5	5	slightly more active than 12°C fish
12°C	12.6	7.3	11.0	120	51	30	5	5	5	5	

DAY 1 (12/2/06) WB

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
17°C	17.0	7.2	9.0	135			5	5	5	5	slightly more active than 12°C fish
12°C	12.2	7.4	11.2	120			5	5	5	5	

DAY 2 (12/3/06) YH

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
17°C	16.5	6.8	9.1	140	51	30	5	5	5	5	≈ 3/4 H <sub>2</sub> O Δ
12°C	12.1	6.9	10.2	125	51	30	5	5	5	5	≈ 3/4 H <sub>2</sub> O Δ

DAY 3 (12/4/06) WZ/653

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
17°C	17.3	7.4	8.8	130			5	5	5	5	slightly more active than 12°C fish
12°C	12.2	7.7	10.4	120			5	5	5	5	

DAY 4 (12/5/06) WM

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
17°C	17.0	7.0	9.0	140	51	30	5	5	5	5	
12°C	12.5	6.9	10.6	130	51	30	5	5	5	5	

X  
SD  
(M)

17	12	17	12	17	12	17	12	51	30
16.9	12.3	7.1	7.2	9.1	10.7	13.4	12.3	0	0
0.4	0.2	0.2	0.3	0.3	0.4	7	4	16	16
(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)		

Test No. 686-37 Client Windward Investigator \_\_\_\_\_

Client: Windward Environmental, 200 West Mercer Street, Suite 401, Seattle, WA 98119  
Client's Study Monitor: Ms. Helle Andersen  
Testing Laboratory: Northwestern Aquatic Sciences  
Test Location: Newport Laboratory  
Laboratory's Study Personnel: LAS

Project Manager/Study Director: G.A. Buhler GH

QA Officer: L.K. Nemeth

2. Greg Hutchinson GH

4. \_\_\_\_\_

1. 6. J. IRISSARRI 631

3. \_\_\_\_\_

5. \_\_\_\_\_

Study Schedule:  
Test Beginning: 12-8-06 1430 Test Ending: 12-12-06 1540

Description: \_\_\_\_\_  
 NAS Sample No.: \_\_\_\_\_  
 Date of Preparation: \_\_\_\_\_  
 : \_\_\_\_\_

Description: City of Newport tap water  
 Date of Preparation/Collection: 12-7-06  
 Water Quality: Cond. ( $\mu\text{mhos/cm}$ ) 120 pH 7.2  
 Hardness ( $\text{mg/L as CaCO}_3$ ) 51 Alkalinity ( $\text{mg/L as CaCO}_3$ ) 30  
 Total Chlorine ( $\text{mg/L, DL 0.02 mg/L}$ ) 10.02  
 Treatments: Dechlorinated, aerated  $\geq 24$  hours

Species: Lampetra sp. Age/Size: 9 mm larvae

Source: Siletz River, Oregon—Cedar Creek area

Acclimation Data: 22°C *see holding data*

[illegible]

Test No. 686-37 Client Windward Investigator \_\_\_\_\_

[illegible]

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-37 Client \_\_\_\_\_ Windward \_\_\_\_\_ Investigator \_\_\_\_\_

## TEST PROCEDURES AND CONDITIONS:

Test Concentrations (10% series recommended): 0 (control).Test Chambers (description): 2.5 gallon glass aquaria covered with plastic wrap and plastic lidsTest Volume (mL): 2.8 L Replicates/treatment: 1Organisms/treatment: 4 (5/rep) Temperature (°C) 12 ± 1 and 22 ± 1Test water changes: one, at 48 hours Aeration during test: YesFeeding: None Test Duration: 96 hrPhotoperiod (L/D): 16/8Beaker Placement: Stratified randomization

Randomization chart: 22°C Location: Room #1

Light intensity (ft.c.): 68-2 12-800 AM

B	D	A	C
---	---	---	---

Randomization chart: 12°C Location: Room #4

Light intensity (ft.c.): 49-5 12-800 AM

D	B	A	C
---	---	---	---

## TEST SOLUTION PREPARATION:

2.8 liters of dilution water per tank.

OB 12-8-06  
GB 12-10-06

## LOADING (g/L):

(weigh and measure length ~~A~~ replicate at end of test)

22°C

Length (mm)	Weight (g)
70	0.56
58	0.32
55	0.31
68	0.48
70	0.51

X  
SD  
(N)

64	0.44
7	0.11
(5)	(5)

Length (mm)	Weight (g)
65	0.41
62	0.30
80	0.66
70	0.48
71	0.55

X  
SD  
(N)

70	0.48
7	0.14
(5)	(5)

NOTES:

$$0.44 \text{ g/fish} \times 5 \text{ fish} \div 2.8 \text{ L} = 0.79 \text{ g/L}$$

$$0.48 \text{ g/fish} \times 5 \text{ fish} \div 2.8 \text{ L} = 0.86 \text{ g/L}$$

## LAMPREY SURVIVAL RANGE-FINDING TEST

Test No. 686-37 Client Windward Investigator                     

## WATER QUALITY DATA SHEET

DAY 0 (12/8/06) WJ

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
22°C	21.8	7.3	8.8	140	51	30	5	5	5	5	
12°C	11.9	7.4	10.6	115	51	30	5	5	5	5	

DAY 1 (12/9/06) 651/64

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
22°C	23.0	6.9	8.2	140			5	5	5	5	
12°C	12.3	7.0	10.1	120			5	5	5	5	

DAY 2 (12/10/06) WJ

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
22°C	22.6	7.3	8.0	140	51	40	5	5	5	5	
12°C	12.6	7.1	10.2	110	51	30	5	5	5	5	

DAY 3 (12/11/06) WJ/651

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
22°C	21.8	7.2	8.2	160			5	5	5	5	
12°C	12.1	7.0	10.9	130			5	5	5	5	

DAY 4 (12/12/06) WJ

Conc. (mg/L)	Temp (°C)	pH	DO (mg/L)	Conductivity (µmhos/cm)	Hardness (mg/L)	Alkalinity (mg/L)	# Survivors				Comments
							A	B	C	D	
22°C	22.2	7.2	8.3	150	51	40	5	4(10)	5	5	
12°C	12.2	7.0	10.8	125	51	40	5	5	5	5	

$\bar{x}$   
SD  
(N)

22 | 12 22 | 12 22 | 12  
22.3 | 12.2 22.2 | 10.8 8.3 | 10.5  
0.5 | 0.3 0.2 | 0.4 0.3 | 0.4  
(5) | (5) (5) (5) | (5) (5)  
CALCULATED  
ERROR  
2-9-07 (5)

22 | 12  
146 | 120  
9 | 8  
(5) | (5)

22 | 12  
51 | 51  
0 | 0  
(3) | (3)

22 | 12  
37 | 33  
6 | 6  
(3) | (3)

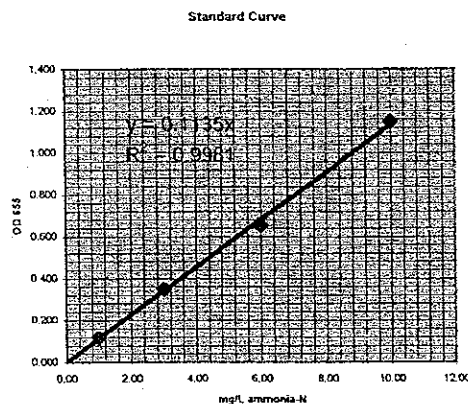


**AMMONIA BENCHSHEETS AND ANALYSIS**

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.117	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.348	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.652	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	----	1.150	10.00
3.0 mg/L spike	----	0.358	3.15
3.0 mg/L spike dupl.	----	0.329	2.90



1.	10-25-06 Tank #14	1	0.004	ND
2.	10-26-06 Tank #2	1	0.000	ND
3.	10-27-06 Tank #17	1	0.003	ND
4.	10-28-06 Tank #3	1	0.003	ND
5.	10-29-06 Tank #11	1	0.009	ND
6.	10-30-06 Tank #5	1	0.008	ND
7.	10-31-06 Tank #19	1	0.010	ND
8.	11-1-06 Tank #14	1	0.002	ND
9.	11-2-06 Tank #6	1	0.001	ND
10.	11-3-06 Tank #9	1	0.000	ND
11.	11-4-06 Tank #13	1	0.002	ND
12.	11-5-06 Tank #16	1	0.001	ND
13.	11-6-06 Tank #1	1	0.004	ND
14.	11-7-06 Tank #11	1	0.008	ND
15.	11-8-06 Tank #17	1	0.006	ND
16.	11-9-06 Tank #4	1	0.004	ND
17.	11-10-06 Tank #16	1	0.002	ND
18.	11/11/2006	1	0.011	ND
19.	11-12-06 Tank #13	1	0.002	ND
20.	11-13-06 Tank #14	1	0.001	ND

Reporting limit (mg/L) = 0.1

Recovery (%) = 100.8

Precision (RPD) = 8.44

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 686 Lamprey holding

Test Day: 10-25-06 to 11-13-06

Species: Lamprey

Overlying water

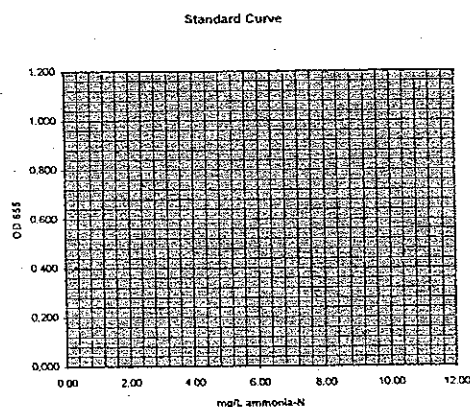
Analyst: RSC

Date analysed: 11/30/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	---	---	---
1.0 mg/L NH <sub>3</sub> -N Std.	---	0.117	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	---	0.348	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	---	0.652	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	---	1.15	10.00
3.0 mg/L spike	---	0.358	
3.0 mg/L spike dupl.	---	0.329	



1.	10-25-06 Tank #14	1	0.04
2.	10-26-06 Tank #2	1	0.00
3.	10-27-06 Tank #17	1	0.03
4.	10-28-06 Tank #3	1	0.03
5.	10-29-06 Tank #11	1	0.07
6.	10-30-06 Tank #5	1	0.08
7.	10-31-06 Tank #19	1	0.10
8.	11-1-06 Tank #14	1	0.02
9.	11-2-06 Tank #6	1	0.01
10.	11-3-06 Tank #9	1	0.00
11.	11-4-06 Tank #13	1	0.02
12.	11-5-06 Tank #16	1	0.01
13.	11-6-06 Tank #1	1	0.04
14.	11-7-06 Tank #11	1	0.08
15.	11-8-06 Tank #17	1	0.06
16.	11-9-06 Tank #4	1	0.04
17.	11-10-06 Tank #16	1	0.02
18.	11/11/2006	1	0.11
19.	11-12-06 Tank #13	1	0.02
20.	11-13-06 Tank #14	1	0.01
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			
36.			

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 686 Lamprey holding

Test Day: 10-25-06 to 11-13-06

Species: Lamprey

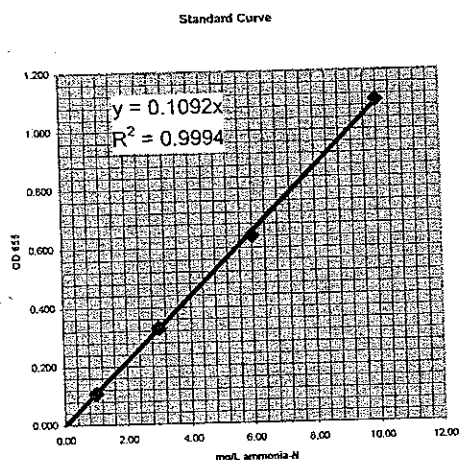
Overlying water

Analyst: RSC  
 Date analysed: 11/30/2006

# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.107	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.330	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.640	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	----	1.100	10.00
3.0 mg/L spike	----	0.325	2.98
3.0 mg/L spike dupl.	----	0.320	2.93
5.0 mg/L 2nd source	----	0.485	4.44
1. 11-14-06 Tank #14	1	0.003	ND
2. 11-15-06 Tank #12	1	0.004	ND
3. 11-16-06 Tank #18	1	0.000	ND
4. 11-17-06 Tank #1	1	0.005	ND
5. 11-18-06 Tank #14	1	0.000	ND
6. 11-20-06 Tank #13	1	0.000	ND
7. 11-22-06 Tank #15	1	0.010	ND
8. 11-24-06 Tank #14	1	0.010	ND
9. 11-25-06 Tank #19	1	0.013	0.12
10. 11-26-06 Tank #18	1	0.005	ND
11. 11-27-06 Tank #12	1	0.012	0.11
12. 11-28-06 Tank #10	1	0.039	0.36
13. 11-29-06 Tank #14	1	0.029	0.27
14. 11-30-06 Tank #18	1	0.021	0.19
15. 12-1-06 Tank #12	1	0.009	ND
16. 12-2-06 Tank #18	1	0.036	0.33
17. 12-3-06 Tank #10	1	0.040	0.37
18. 12-4-06 Tank #14	1	0.021	0.19
19. 12-5-06 Tank #12	1	0.030	0.27
20. 12-6-06 Tank #12	1	0.019	0.17
21. 12-7-06 Tank #13	1	0.022	0.20
22. 12-8-06 Tank #14	1	0.030	0.27
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			
36.			



Reporting limit (mg/L) = 0.1

Recovery (%) = 98.5

Precision (RPD) = 1.55

2nd source (%) = 88.8

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 686 Lamprey holding 12°

Test Day: 11-14-06 to 12-8-06

Species: Lamprey

Overlying water

Analyst:

GJI

Date analysed:

12/29/06

Total Ammonia-N in Water: Computation Worksheet			
Salicylate Method (SOP #5492)			
<b>Result</b>			
Sample description	Dilution factor	OD655	NH <sub>3</sub> -N (mg/L)
Blank	----	----	----
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.107	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.330	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.640	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	----	1.100	10.00
3.0 mg/L spike	----	0.325	
3.0 mg/L spike dupl.	----	0.320	
5.0 mg/L 2nd source	----	0.485	
1. 11-14-06 Tank #14	1	0.003	
2. 11-15-06 Tank #12	1	0.004	
3. 11-16-06 Tank #18	1	0.000	
4. 11-17-06 Tank #1	1	0.005	
5. 11-18-06 Tank #14	1	0.000	
6. 11-20-06 Tank #13	1	0.000	
7. 11-22-06 Tank #15	1	0.010	
8. 11-24-06 Tank #14	1	0.010	
9. 11-25-06 Tank #19	1	0.013	
10. 11-26-06 Tank #18	1	0.005	
11. 11-27-06 Tank #12	1	0.012	
12. 11-28-06 Tank #10	1	0.039	
13. 11-29-06 Tank #14	1	0.029	
14. 11-30-06 Tank #18	1	0.021	
15. 12-1-06 Tank #12	1	0.009	
16. 12-2-06 Tank #18	1	0.036	
17. 12-3-06 Tank #10	1	0.040	
18. 12-4-06 Tank #14	1	0.021	
19. 12-5-06 Tank #12	1	0.030	
20. 12-6-06 Tank #12	1	0.019	
21. 12-7-06 Tank #13	1	0.022	
22. 12-8-06 Tank #14	1	0.030	
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			
36.			

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor: 1

**Sample Set Description:**

Test No.: 686 Lamprey holding 12°

Test Day: 11-14-06 to 12-8-06

Species: Lamprey

Overlying water

Analyst: 651

Date analysed: 12-29-06

Total Ammonia-N in Water: Computation Worksheet				
Salicylate Method (SOP #5492)				
<b>Result</b>				
Sample	Dilution		NH <sub>3</sub> -N	
description	factor	OD <sub>655</sub>	(mg/L)	
Blank	-----	-----	-----	
1.0 mg/L NH <sub>3</sub> -N Std.	-----	0.107	1.00	
3.0 mg/L NH <sub>3</sub> -N Std.	-----	0.330	3.00	
6.0 mg/L NH <sub>3</sub> -N Std.	-----	0.640	6.00	
10.0 mg/L NH <sub>3</sub> -N Std.	-----	1.100	10.00	
3.0 mg/L spike	-----	0.325	2.98	
3.0 mg/L spike dupl.	-----	0.320	2.93	
5.0 mg/L 2nd source	-----	0.485	4.44	
1. 11-24-06 Tank #1	1	0.000	ND	
2. 11-25-06 Tank #15	1	0.008	ND	
3. 11-26-06 Tank #17	1	0.000	ND	
4. 11-27-06 Tank #1	1	0.002	ND	
5. 11-28-06 Tank #16	1	0.003	ND	
6. 11-29-06 Tank #17	1	0.009	ND	
7. 11-30-06 Tank #15	1	0.008	ND	
8. 12-1-06 Tank #16	1	0.000	ND	
9.				
10.				
11.				
12.				
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32.				
33.				
34.				
35.				
36.				

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = 98.5

Precision (RPD) = 1.55

2nd source (%) = 88.8

Sample volume (ml): 0.50

Dilution factor: 1

**Sample Set Description:**

Test No.: 686 Lamprey holding 17°

Test Day: 11-24-06 to 12-1-06

Species: Lamprey

Overlying water

Analyst: GJI

Date analysed: 12/29/06

Total Ammonia-N in Water: Computation Worksheet				
Salicylate Method (SOP #5492)				
<b>Result</b>				
Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	
Blank	----	----	----	
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.107	1.00	
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.330	3.00	
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.640	6.00	
10.0 mg/L NH <sub>3</sub> -N Std.	----	1.100	10.00	
3.0 mg/L spike	----	0.325		
3.0 mg/L spike dupl.	----	0.320		
5.0 mg/L 2nd source	----	0.435		
1. 11-24-06 Tank #1	1	0.000		
2. 11-25-06 Tank #15	1	0.003		
3. 11-26-06 Tank #17	1	0.000		
4. 11-27-06 Tank #1	1	0.002		
5. 11-28-06 Tank #16	1	0.003		
6. 11-29-06 Tank #17	1	0.009		
7. 11-30-06 Tank #15	1	0.008		
8. 12-1-06 Tank #16	1	0.600		
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor: 1

**Sample Set Description:**

Test No.: 686 Lamprey holding 17°

Test Day: 11-24-06 to 12-1-06

Species: Lamprey

Overlying water

Analyst: GJ1

Date analysed: 12-29-06

Total Ammonia-N in Water: Computation Worksheet				
Salicylate Method (SOP #5492)				
Result				
Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)	
Blank	----	----	----	
1.0 mg/L NH <sub>3</sub> -N Std.	----	0.107	1.00	
3.0 mg/L NH <sub>3</sub> -N Std.	----	0.330	3.00	
6.0 mg/L NH <sub>3</sub> -N Std.	----	0.640	6.00	
10.0 mg/L NH <sub>3</sub> -N Std.	----	1.100	10.00	
3.0 mg/L spike	----	0.325	2.98	
3.0 mg/L spike dupl.	----	0.320	2.93	
5.0 mg/L 2nd source	----	0.485	4.44	
1. 12-2-06 Tank #15	1	0.000	ND	
2. 12-3-06 Tank #15	1	0.000	ND	
3. 12-4-06 Tank #1	1	0.007	ND	
4. 12-5-06 Tank #15	1	0.006	ND	
5. 12-6-06 Tank #17	1	0.002	ND	
6. 12-7-06 Tank #15	1	0.000	ND	
7. 12-8-06 Tank #1	1	0.000	ND	
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				

Standard Curve

Reporting limit (mg/L) = 0.1

Recovery (%) = 98.5

Precision (RPD) = 1.55

2nd source (%) = 88.8

Sample volume (ml): 0.50

Dilution factor 1

Sample Set Description:

Test No.: 686 Lamprey holding 22°

Test Day: 12-2-06 to 12-8-06

Species: Lamprey

Overlying water

Analyst: GJI

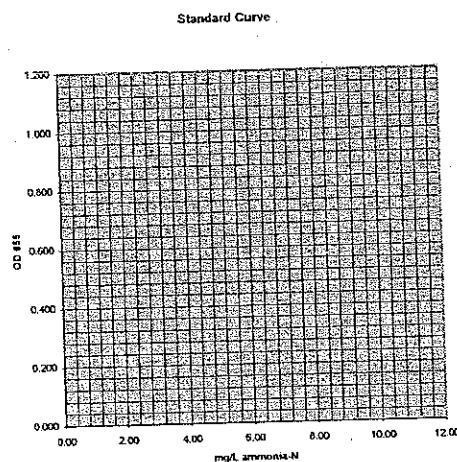
Date analysed: 12/29/06



# **Total Ammonia-N in Water: Computation Worksheet** **Salicylate Method (SOP #5492)**

**Result**

Sample description	Dilution factor	OD <sub>655</sub>	NH <sub>3</sub> -N (mg/L)
Blank	-----	-----	-----
1.0 mg/L NH <sub>3</sub> -N Std.	-----	0.107	1.00
3.0 mg/L NH <sub>3</sub> -N Std.	-----	0.330	3.00
6.0 mg/L NH <sub>3</sub> -N Std.	-----	0.640	6.00
10.0 mg/L NH <sub>3</sub> -N Std.	-----	1.100	10.00
3.0 mg/L spike	-----	0.325	
3.0 mg/L spike dupl.	-----	0.320	
5.0 mg/L 2nd source	-----	0.495	



1.	12-2-06 Tank #15	1	0.000
2.	12-3-06 Tank #15	1	0.000
3.	12-4-06 Tank #1	1	0.007
4.	12-5-06 Tank #15	1	0.006
5.	12-6-06 Tank #17	1	0.002
6.	12-7-06 Tank #15	1	0.000
7.	12-8-06 Tank #1	1	0.000

Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!

Precision (RPD) = #VALUE!

2nd source (%) = #VALUE!

Sample volume (ml): 0.50

Dilution factor 1

**Sample Set Description:**

Test No.: 686 Lamprey holding 22°

Test Day: 12-2-06 to 12-8-06

Species: Lamprey

Overlying water

Analyst:

Date analysed:

651

12-29-06

**TEST DATA ANALYSIS RECORDS**

for entry vented against  
laboratory bench sheet 2/15/07

	Date	Temp	pH	DO	Cond	Hard	Alk	NH3	rec'ing data	comments
Siletz River	10/17/06	13.6	5.3	8.2	62	26	20			
Water	10/17/06					26				
	10/18/06	12.4	6.0	9.6	95	26	20		rec'ing data	
	10/23/06	11.5	6.8	8.4	75	26	20		rec'ing data	
	10/24/06	10.6	6.0	8.8	150	51	90		rec'ing data	
Siletz River	Mean	12.0	6.0	8.8	96	31	38	---		
Water	SD	1.3	0.6	0.6	39	11	35	---		
	n	4	4	4	4	5	4	---		
	Min	10.6	5.3	8.2	62	26	20	---		
	Max	13.6	6.8	9.6	150	51	90	---		
Lab Holding										
holding for tests	10/18/06	12.3	7.4	10.7	135	43	50			
31-35	10/19/06	12.5	7.1	10.8	133	51	60			
	10/20/06	12.7	7.5	10.6	120	51	30			
	10/21/06	12.5	7.5	11.1	130	43	30			
	10/22/06	12.2	7.1	10.9	125	51	60			
	10/23/06	12.6	6.9	10.8	120	51	30			
	10/24/06	12.3	7.4	10.8	130	51	50			
	10/25/06	12.4	6.9	10.8	130	43	30	<0.1		
	10/26/06	12.6	7.4	10.6	130	43	50	<0.1		
	10/27/06	12.4	7.0	11.2	130	43	50	<0.1		
	10/28/06	12.4	7.1	10.8	130	43	40	<0.1		
	10/29/06	12.9	8.1	10.8	135	51	50	<0.1		
	10/30/06	12.7	8.0	10.4	130	43	50	<0.1		
	10/31/06	12.8	7.8	10.2	130	43	40	<0.1		
	11/1/06	12.6	7.9	10.3	135	43	40	<0.1		
	11/2/06	12.1	8.2	10.3	130	51	50	<0.1		
	11/3/06	11.8	7.9	10.8	130	51	40	<0.1		
	11/4/06	11.2	8.0	11.6	130	51	40	<0.1		
	11/5/06	11.6	7.9	11.2	135	51	50	<0.1		
	11/6/06	13.2	7.9	13.0	119	51	30	<0.1		
	11/7/06	11.9	7.7	11.4	130	51	50	<0.1		
	11/8/06	11.5	8.0	11.2	125	51	50	<0.1		
	11/9/06	11.8	8.0	11.3	125	51	40	<0.1	tests 31 - 34 began 11/9/06	
holding for test 35	11/10/06	11.7	7.9	11.2	115	43	50	<0.1		
continues	11/11/06	11.2	7.7	11.1	120	51	40	<0.1		
	11/12/06	11.3	7.8	11.0	130	51	40	<0.1		

Water Quality Data

P686 Lamprey 2006 holding

	11/13/06	11.4	7.6	11.0	130	51	40	<0.1	
	11/14/06	11.6	7.5	10.9	125	51	40	<0.1	
	11/15/06	11.8	7.6	10.9	132	51	40	<0.1	
	11/16/06	11.4	7.4	11.4	130	43	50	<0.1	test 35 began 11/16/06
Interim holding	11/17/06	11.6	7.6	11.3	117	51	40	<0.1	
prior to acclimation	11/18/06	11.8	7.4	11.2	120	51	40	<0.1	
for temperature	11/20/06	11.9	7.3	11.4	110	51	40	<0.1	
experiments	11/21/06							<0.1	flow off, all tanks fed
	11/22/06	11.4	7.2	11.2	125	51	50	<0.1	
temperature	11/24/06	11.6	7.4	11.6	120	51	40	<0.1	
acclimation to 12C	11/25/06	12.0	7.6	11.3	135	60	50	0.1	
for test #36	11/26/06	11.9	7.6	11.2	140	60	50	<0.1	
	11/27/06	11.6	7.3	11.2	140	51	30	0.1	
	11/28/06	11.6	7.5	11.2	150	60	50	0.4	
	11/29/06	11.3	7.4	11.2	140	51	50	0.3	
	11/30/06	11.7	7.5	11.0	135	60	40	0.2	
	12/1/06	11.8	7.4	11.4	130	60	40	<0.1	test 36 (12C & 17C) began 12/1/06
temperature	12/2/06	11.9	7.3	11.2	130	51	40	0.3	
acclimation to 12C	12/3/06	11.8	7.0	10.4	145	51	30	0.4	
for test #37	12/4/06	11.4	7.3	10.6	140	60	40	0.2	
	12/5/06	11.0	6.9	11.2	140	51	40	0.3	
	12/6/06	12.2	7.3	10.7	125	60	40	0.2	
	12/7/06	12.0	7.4	10.9	135	60	40	0.2	
	12/8/06	12.2	7.4	11.0	120	51	40	0.3	test 37 (12C & 22C) began 12/8/06
temperature	11/24/06	12.2	7.2	11.4	125	51	40	<0.1	
acclimation to 17C	11/25/06	13.5	7.3	10.7	135	60	50	<0.1	
for test #36	11/26/06	14.6	7.5	10.2	140	60	40	<0.1	
	11/27/06	15.5	7.3	9.8	145	60	40	<0.1	
	11/28/06	16.8	7.8	9.6	140	60	50	<0.1	
	11/29/06	16.8	7.7	9.4	140	51	50	<0.1	
	11/30/06	17.0	7.5	9.3	140	60	40	<0.1	
	12/1/06	16.3	7.4	9.4	140	60	40	<0.1	test 36 (12C & 17C) began 12/1/06
temperature	12/1/06	16.9	7.3	8.8	145	51	30		
acclimation to 22C	12/2/06	17.9	7.3	8.9	140	51	30	<0.1	
for test #37	12/3/06	18.5	7.2	8.8	160	51	30	<0.1	
	12/4/06	19.3	7.2	9.0	155	51	40	<0.1	
	12/5/06	20.4	7.3	8.7	170	51	40	<0.1	
	12/6/06	21.6	7.5	8.5	155	51	50	<0.1	
	12/7/06	21.1	7.4	8.8	150	51	50	<0.1	
	12/8/06	21.9	7.5	8.8	150	51	40	<0.1	test 37 (12C & 22C) began 12/8/06

Tests 31 - 34: 10/18/06-11/9/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	12.3	7.6	10.9	129	48	44	---
	n	0.5	0.4	0.6	5	4	9	---
	Min	23	23	23	23	23	23	16
	Max	11.2	6.9	10.2	119	43	30	<0.1
Test 35: 10/18/06-11/16/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	12.1	7.6	11.0	128	48	44	---
	n	0.6	0.4	0.5	5	4	9	---
	Min	30	30	30	30	30	30	23
	Max	11.2	6.9	10.2	115	43	30	<0.1
Test 36, 12C: 11/24/06-12/1/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	11.7	7.5	11.3	136	57	44	---
	n	0.2	0.1	0.2	9	5	7	---
	Min	8	8	8	8	8	8	8
	Max	11.3	7.3	11.0	120	51	30	<0.1
Test 36, 17C: 11/24/06-12/1/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	15.3	7.5	10.0	138	58	44	---
	n	1.8	0.2	0.7	6	4	5	---
	Min	8	8	8	8	8	8	8
	Max	12.2	7.2	9.3	125	51	40	<0.1
Test 37, 12C: 12/2/06-12/8/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	11.8	7.2	10.9	133.6	55	39	---
	n	0.4	0.2	0.3	9.0	5	4	---
	Min	7	7	7	7	7	7	7
	Max	11.0	6.9	10.4	120.0	51	30	0.2
Test 37, 22C: 12/1/06-12/8/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	12.2	7.4	11.2	145.0	60	40	0.4
	n	19.7	7.3	8.8	153	51	39	---
	Min	1.8	0.1	0.1	9	0	8	---
	Max	8	8	8	8	8	8	7
Test 37, 22C: 12/1/06-12/8/06	Mean	Temp	pH	DO	Cond	Hard	Alk	NH3
	SD	16.9	7.2	8.5	140	51	30	<0.1
	n	21.9	7.5	9.0	170	51	50	<0.1
	Min	16.9	7.2	8.5	140	51	30	<0.1
	Max	21.9	7.5	9.0	170	51	50	<0.1

Data Entry verified  
against laboratory  
bench sheets  
2-19-07  
JRF

Aniline mg/L	Test 686-31 DAY	TEMP	pH	DO	COND	HARD	ALK
1,000	0	12.8	7.6	10.5	120	51	440
100	0	12.8	7.4	10.4			
10	0	12.9	7.4	10.4			
1	0	12.8	7.2	10.5			
0	0	12.8	7.2	10.4	110	51	40
1,000	1	12.4	7.4	10.3			
100	1	12.4	7.4	10.2			
10	1	12.3	7.4	10.4			
1	1	12.4	7.3	10.3			
0	1	12.3	7.2	10.2			
1,000	2	12.6	7.5	10.1	125	51	460
100	2	12.5	7.4	10.6			
10	2	12.4	7.4	10.6			
1	2	12.5	7.3	10.6			
0	2	12.4	7.3	10.6	120	51	40
1,000	3	12.8	7.6	10.4			
100	3	12.8	7.5	10.2			
10	3	12.6	7.4	9.9			
1	3	12.8	7.5	10.1			
0	3	12.9	7.5	10.2			
1,000	4	12.5	7.5	10.2	125	51	440
100	4	12.6	7.3	10.1			
10	4	12.3	7.3	10.3			
1	4	12.5	7.2	10.2			
0	4	12.4	7.2	10.2	120	51	40
Mean		12.6	7.4	10.3	---	---	---
SD		0.2	0.1	0.2	---	---	---
n		25	25	25	6	6	6
Min		12.3	7.2	9.9	110	51	40
Max		12.9	7.6	10.6	125	51	460

data entry verified  
against laboratory  
bench sheets  
2-19-07

Copper mg/L	Test 686-32 DAY	TEMP	pH	DO	COND	HARD	ALK
1.0	0	12.2	6.9	10.8	110	51	40
0.1	0	12.1	7.1	10.8			
0.01	0	12.2	7.1	10.7			
0.001	0	12.1	7.1	10.8			
0	0	12.3	7.1	10.6	110	51	40
1	1	12.2	7.2	10.6			
0.1	1	12.3	7.2	10.4			
0.01	1	12.3	7.2	10.2			
0.001	1	12.4	7.2	10.5			
0	1	12.6	7.2	10.3			
1.0	2	12.2	7.3	10.7	120	51	40
0.1	2	12.3	7.3	10.6			
0.01	2	12.3	7.3	10.6			
0.001	2	12.3	7.3	10.6			
0	2	12.6	7.3	10.4	115	51	40
1.0	3	12.7	7.5	10.4			
0.1	3	12.7	7.6	10.3			
0.01	3	12.8	7.6	10.5			
0.001	3	12.6	7.6	10.4			
0	3	12.8	7.6	10.4			
1.0	4	12.1	7.3	10.5	115	51	40
0.1	4	12.1	7.3	10.3			
0.01	4	12.1	7.2	10.4			
0.001	4	12.1	7.2	10.3			
0	4	12.1	7.2	10.2	110	51	40
Mean		12.3	7.3	10.5	---	---	---
SD		0.2	0.2	0.2	---	---	---
n		25	25	25	6	6	6
Min		12.1	6.9	10.2	110	51	40
Max		12.8	7.6	10.8	120	51	40

Pentachlorophenol		Test 686-33					
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK
4.0	0	12.2	7.2	10.4	115	51	40
0.4	0	12.2	7.1	10.4			
0.004	0	12.2	7.1	10.2			
0.004	0	12.2	7.1	10.4			
0	0	12.3	7.1	10.4	110	51	40
4.0	1	12.2	7.4	10.2			
0.4	1	12.2	7.3	10.4			
0.004	1	12.2	7.3	10.4			
0.004	1	12.2	7.2	10.2			
0	1	12.2	7.2	10.3			
4.0	2	12.2	7.5	10.5	125	51	40
0.4	2	12.2	7.4	10.5			
0.004	2	12.2	7.3	10.4			
0.004	2	12.3	7.3	10.6			
0	2	12.3	7.3	10.5	120	51	40
4.0	3	12.7	7.6	10.3			
0.4	3	12.7	7.6	10.4			
0.004	3	12.7	7.6	10.2			
0.004	3	12.8	7.6	10.3			
0	3	12.8	7.5	10.2			
4.0	4	12.1	7.3	10.6	115	51	40
0.4	4	12.1	7.3	10.6			
0.004	4	12.1	7.3	10.5			
0.004	4	12.1	7.2	10.4			
0	4	12.1	7.2	10.4	115	51	40
Mean		12.3	7.3	10.4	---	---	---
SD		0.2	0.2	0.1	---	---	---
n		25	25	25	6	6	6
Min		12.1	7.1	10.2	110	51	40
Max		12.8	7.6	10.6	125	51	40

Data Entry verified  
against Laboratory  
bench sheets  
2-19-07  
JUF



Lindane mg/L	Test 686-34 DAY	TEMP	pH	DO	COND	HARD	ALK
8.0	0	12.2	7.3	10.4	115	51	40
0.8	0	12.2	7.3	10.2			
0.08	0	12.3	7.2	10.2			
0.008	0	12.1	7.2	10.4			
0	0	12.2	7.2	10.2	115	51	40
8.0	1	12.1	7.5	10.1			
0.8	1	12.1	7.4	10.2			
0.08	1	12.2	7.3	10.5			
0.008	1	12.2	7.3	10.2			
0	1	12.1	7.3	10.4			
8.0	2	12.2	7.5	10.4	120	51	40
0.8	2	12.2	7.4	10.5			
0.08	2	12.2	7.4	10.4			
0.008	2	12.1	7.4	10.8			
0	2	12.2	7.3	10.6	120	51	40
8.0	3	12.7	7.6	10.4			
0.8	3	12.6	7.6	10.2			
0.08	3	12.8	7.6	10.3			
0.008	3	12.8	7.5	10.3			
0	3	12.6	7.5	10.4			
8.0	4	12.1	7.4	10.3	115	51	40
0.8	4	12.2	7.3	10.2			
0.08	4	12.2	7.3	10.4			
0.008	4	12.3	7.3	10.3			
0	4	12.1	7.2	10.2	115	51	40
Mean		12.3	7.4	10.3	---	---	---
SD		0.2	0.1	0.2	---	---	---
n		25	25	25	6	6	6
Min		12.1	7.2	10.1	115	51	40
Max		12.8	7.6	10.8	120	51	40

Data Entry Verified  
against Laboratory  
bench sheets  
2-19-07 JRF

Data Entry Verified  
against Laboratory  
Bench Sheets 2-19-07  
JZF

Diazinon mg/L	Test 686-35 DAY	TEMP	pH	DO	COND	HARD	ALK
40	0	12.2	7.3	10.6	115	51	30
4.0	0	12.1	7.3	10.6			
0.4	0	12.2	7.3	10.5			
0.04	0	12.1	7.3	10.7			
0	0	12.1	7.3	10.6	115	51	30
40	1	11.8	7.1	10.6			
4.0	1	11.8	7.1	10.5			
0.4	1	11.7	7.1	10.5			
0.04	1	11.8	7.1	10.4			
0	1	11.8	7.1	10.5			
40	2	11.9	7.3	10.4	120	51	30
4.0	2	12.0	7.3	10.3			
0.4	2	11.9	7.2	10.5			
0.04	2	11.7	7.2	10.6			
0	2	11.8	7.2	10.6	125	51	30
40	3	11.8	7.3	10.6			
4.0	3	11.7	7.3	10.4			
0.4	3	11.8	7.3	10.3			
0.04	3	11.8	7.3	10.3			
0	3	11.9	7.3	10.2			
40	4	11.9	7.3	10.5	120	51	30
4.0	4	11.8	7.3	10.6			
0.4	4	11.8	7.3	10.5			
0.04	4	11.9	7.3	10.3			
0	4	12	7.3	10.4	120	51	40
Mean		11.9	7.2	10.5	---	---	---
SD		0.1	0.1	0.1	---	---	---
n		25	25	25	6	6	6
Min		11.7	7.1	10.2	115	51	30
Max		12.2	7.3	10.7	125	51	40

Data Entry verified  
against Laboratory  
Bench sheets  
2-19-07 JRF

Temperature Experiment #1			Test 686-36				
12C	DAY	TEMP	pH	DO	COND	HARD	ALK
12C	0	12.6	7.3	11	120	51	30
12C	1	12.2	7.4	11.2	120		
12C	2	12.1	6.9	10.2	125	51	30
12C	3	12.2	7.4	10.4	120		
12C	4	12.5	6.9	10.6	130	51	30
	Mean	12.3	7.2	10.7	123	51	30
	SD	0.2	0.3	0.4	4	0	0
	n	5	5	5	5	3	3
	Min	12.1	6.9	10.2	120	51	30
	Max	12.6	7.4	11.2	130	51	30
17C	DAY	TEMP	pH	DO	COND	HARD	ALK
17C	0	16.5	7.3	9.7	125	51	30
17C	1	17.0	7.2	9	135		
17C	2	16.5	6.8	9.1	140	51	30
17C	3	17.3	7.4	8.8	130		
17C	4	17.0	7.0	9.0	140	51	30
	Mean	16.9	7.1	9.1	134	51	30
	SD	0.4	0.2	0.3	7	0	0
	n	5	5	5	5	3	3
	Min	16.5	6.8	8.8	125	51	30
	Max	17.3	7.4	9.7	140	51	30

Temperature Experiment #2			Test 686-37				
12C	DAY	TEMP	pH	DO	COND	HARD	ALK
12C	0	11.9	7.4	10.6	115	51	30
12C	1	12.3	7.0	10.1	120		
12C	2	12.6	7.1	10.2	110	51	30
12C	3	12.1	7.0	10.9	130		
12C	4	12.2	7.0	10.8	125	51	40
	Mean	12.2	7.1	10.5	120	51	33
	SD	0.3	0.2	0.4	8	0	6
	n	5	5	5	5	3	3
	Min	11.9	7.0	10.1	110	51	30
	Max	12.6	7.4	10.9	130	51	40
22C	DAY	TEMP	pH	DO	COND	HARD	ALK
22C	0	21.8	7.3	8.8	140	51	30
22C	1	23.0	6.9	8.2	140		
22C	2	22.6	7.3	8	140	51	40
22C	3	21.8	7.2	8.2	160		
22C	4	22.2	7.2	8.3	150	51	40
	Mean	22.3	7.2	8.3	146	51	37
	SD	0.5	0.2	0.3	9	0	6
	n	5	5	5	5	3	3
	Min	21.8	6.9	8.0	140	51	30
	Max	23.0	7.3	8.8	160	51	40

Test ID	Test No.	Nom. Conc. mg/L	Number Exposed	Number Surviving	% Surv.
Aniline	686-31	1,000	5	0	0
		100	5	5	100
		10	5	5	100
		1	5	5	100
		0	5	5	100
Copper	686-32	1	5	0	0
		0.1	5	2	40
		0.01	5	5	100
		0.001	5	5	100
		0	5	5	100
Penta	686-33	4	5	0	0
		0.4	5	0	0
		0.04	5	5	100
		0.004	5	5	100
		0	5	5	100
Lindane	686-34	8	5	0	0
		0.8	5	5	100
		0.08	5	5	100
		0.008	5	5	100
		0	5	5	100
Diazinon	686-35	40	5	0	0
		4	5	5	100
		0.4	5	5	100
		0.04	5	5	100
		0	5	5	100
17C	686-36	17C	5	5	100
		17C	5	5	100
		17C	5	5	100
		17C	5	5	100
12C	686-36	12C	5	5	100
		12C	5	5	100
		12C	5	5	100
		12C	5	5	100
22C	686-37	22C	5	5	100
		22C	5	4	80
		22C	5	5	100
		22C	5	5	100
12C	686-37	12C	5	5	100
		12C	5	5	100
		12C	5	5	100
		12C	5	5	100

Test ID	Test No.	Length (mm)	Weight (g)		Length (mm)	Weight (g)
Aniline	686-31	72	0.49	Mean	74	0.54
		67	0.38	SD	6	0.15
		71	0.47	n	5	5
		79	0.63	Min	67	0.38
		83	0.75	Max	83	0.75
Copper	686-32	55	0.25	Mean	54	0.26
		51	0.19	SD	3	0.09
		50	0.19	n	5	5
		56	0.24	Min	50	0.19
		58	0.42	Max	58	0.42
Penta	686-33	55	0.25	Mean	57	0.28
		51	0.18	SD	14	0.21
		50	0.15	n	5	5
		49	0.17	Min	49	0.15
		82	0.66	Max	82	0.66
Lindane	686-34	59	0.27	Mean	69	0.43
		58	0.27	SD	12	0.21
		68	0.37	n	5	5
		70	0.43	Min	58	0.27
		88	0.79	Max	88	0.79
Diazinon	686-35	70	0.41	Mean	74	0.52
		90	0.90	SD	9	0.22
		70	0.38	n	5	5
		74	0.53	Min	68	0.38
		68	0.40	Max	90	0.90
17C	686-36	80	0.72	Mean	74	0.59
		71	0.46	SD	7	0.15
		65	0.44	n	5	5
		72	0.55	Min	65	0.44
		82	0.78	Max	82	0.78
12C	686-36	88	1.00	Mean	66	0.55
		72	0.66	SD	15	0.28
		60	0.36	n	5	5
		64	0.42	Min	46	0.33
		46	0.33	Max	88	1.00
22C	686-37	70	0.56	Mean	64	0.44
		58	0.32	SD	7	0.11
		55	0.31	n	5	5
		68	0.48	Min	55	0.31
		70	0.51	Max	70	0.56
12C	686-37	65	0.41	Mean	70	0.48
		62	0.30	SD	7	0.14
		80	0.66	n	5	5
		70	0.48	Min	62	0.30
		71	0.55	Max	80	0.66
	Mean	67	0.45			
	SD	11	0.20			
	n	45	45			
	Min	46	0.15			
	Max	90	1.00			

data Entry verified  
against laboratory  
bench sheets  
2-19-07 JMF

**CHAIN-OF-CUSTODY RECORDS**

**N<sup>o</sup> 2409**

Ship to: 2245

Attn: Gary Bubler

Shipping Date: 10-17-06

Shipper:

Airbill Number:

Form filled out by: T.D.D.

[illegible]

\* Distribution: White copies accompany shipment; yellow retained by consignor.

**To be completed by Laboratory upon sample receipt:**

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

Windward Environmental LLC

1 of 1

Ship to: N. A.S.

Attn: Gary Buhler

Shipper: hand del'd

Form filled out by: T.D.

T Do, M Luxon

T. 120

Turnaround requested:

\* Distribution: White copies accompany shipment; yellow retained by consignor.

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

Windward<sup>LLC</sup>  
environmental

**To be completed by Laboratory upon sample receipt:**

Date of receipt:	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:



№ 2408

Of

Project/Client Name: LWG EIA - Airport Amendment (toxicity)

Project Number: 06-28-04-45

Contact Name: Helle Andersen

Sampled By: TDo J Buewing

Ship to: N. A.S.

Attn: Gary Buhler

Shipper: Hand del'd.

Form filled out by: T.D.

Shipping Date:

Airbill Number:

Turnaround requested:

[illegible]

\* Distribution: White: copies accompany shipment; yellow retained by consignor.

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

~~Windward~~ environmental LLC

**To be completed by Laboratory upon sample receipt:**

Date of receipt:	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

Nº 2411

Sampled By: T.D. JB

Form filled out by: T. D.

Airbill Number:

Turnaround requested:

[illegible]

To be completed by Laboratory upon sample receipt:

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

200 West Mercer Street  
Suite 401  
Seattle, WA 98119  
Tel: (206) 378-1364  
Fax: (206) 217-9343

**Windward**  
environmental LLC

[illegible]

# CHAIN OF CUSTODY RECORD

## Northwestern Aquatic Sciences

3814 Yaquina Bay Rd., P.O. Box 1437, Newport, OR 97365  
Tel: 541-265-7225, Fax: 541-265-2799, www.nwaquatic.com



Client Name Windward Environmental		Project No. 06-28-04-45		Shipping Information		Testing Required				Comments
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119		Phone No. 206-577-1287		Carrier: UPS Airbill No. 12 844167 0110033034		Copper	Lindane	Pentachlorophenol	Aniline	
Lab Sample No.	Date Sampled	Time Sampled	Sample Description	Number of Containers						
	11-9-06	1415	NAS# 0780G Day 0 - 4.0 mg/L Penta	1				X		
	11-9-06	1415	NAS# 0781G Day 0 - 0.4 mg/L Penta	1				X		
	11-9-06	1415	NAS# 0782G Day 0 - 0.04 mg/L Penta	1				X		
	11-9-06	1415	NAS# 0783G Day 0 - 0.004 mg/L Penta	1				X		
	11-9-06	1415	NAS# 0784G Day 0 - 0 mg/L Penta	1				X		
	11-9-06	1440	NAS# 0785G Day 0 - 8.0 mg/L Lindane	1		X				
	11-9-06	1440	NAS# 0786G Day 0 - 0.8 mg/L Lindane	1		X				
	11-9-06	1440	NAS# 0787G Day 0 - 0.08 mg/L Lindane	1		X				
	11-9-06	1440	NAS# 0788G Day 0 - 0.008 mg/L Lindane	1		X				
	11-9-06	1440	NAS# 0789G Day 0 - 0 mg/L Lindane	1		X				
Signature					Company	Date	Time	Cooler Custody Seal		
Relinquished by <i>Gary A. Buhler</i>					NAS	11-10-06	1320	Present / Not Present		
Received by								Intact / Not Intact		
Relinquished by								Internal Cooler Temperature Upon Lab Receipt (°C)		
Received by										
Relinquished by										
Received by laboratory										



Client Name Windward Environmental				Project No. 06-28-04-45		Shipping Information				Testing Required			
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119				Phone No. 206-577-1287		Carrier: UPS		Airbill No. 12 849 169 01 1003 261 5		Copper	Lindane	Pentachlorophenol	Aniline
Lab Sample No.	Date Sampled	Time Sampled	Sample Description	Report Attention Helle Anderson	Sampled by G.A. Buhler	Number of Containers	Comments						
	11-11-06	1620	NAS# 0795G 48-hr - 1.0 mg/L Cu OLD			1	X						
	11-11-06	1620	NAS# 0796G 48-hr - 0.1 mg/L Cu OLD			1	X						
	11-11-06	1620	NAS# 0797G 48-hr - 0.01 mg/L Cu OLD			1	X						
	11-11-06	1620	NAS# 0798G 48-hr - 0.001 mg/L Cu OLD			1	X						
	11-11-06	1620	NAS# 0799G 48-hr - 0 mg/L Cu OLD			1	X						
	11-11-06	1545	NAS# 0800G 48-hr - 1.0 mg/L Cu NEW			1	X						
	11-11-06	1545	NAS# 0801G 48-hr - 0.1 mg/L Cu NEW			1	X						
	11-11-06	1545	NAS# 0802G 48-hr - 0.01 mg/L Cu NEW			1	X						
	11-11-06	1545	NAS# 0803G 48-hr - 0.001 mg/L Cu NEW			1	X						
	11-11-06	1545	NAS# 0804G 48-hr - 0 mg/L Cu NEW			1	X						
Relinquished by <i>Julie Fiske</i>				Print Name Julie Fiske		Company NAS		Date 11-13-06		Time 10:00		Cooler Custody Seal Present / Not Present Intact / Not Intact	
Received by												Internal Cooler Temperature Upon Lab Receipt (°C)	
Relinquished by													
Received by													
Relinquished by													
Received by laboratory													

[illegible]

# CHAIN OF CUSTODY RECORD

## Northwestern Aquatic Sciences

3814 Yaquina Bay Rd., P.O. Box 1437, Newport, OR 97365  
Tel: 541-265-7225, Fax: 541-265-2799, www.nwaquatic.com



Client Name Windward Environmental		Project No. 06-28-04-45		Shipping Information		Testing Required				Comments
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119		Phone No. 206-577-1287		Carrier: UPS Airbill No. 12 044 164 01 1003 259 9		Copper	Lindane	Pentachlorophenol	Aniline	
Lab Sample No.	Date Sampled	Time Sampled	Sampled by G.A. Buhler	Sample Description	Number of Containers					
	11-11-06	1635		NAS# 0815G 48hr - 8.0 mg/L Lindane OLD	1		X			
	11-11-06	1635		NAS# 0816G 48hr - 0.8 mg/L Lindane OLD	1		X			
	11-11-06	1635		NAS# 0817G 48hr - 0.08 mg/L Lindane OLD	1		X			
	11-11-06	1635		NAS# 0818G 48hr - 0.008 mg/L Lindane OLD	1		X			
	11-11-06	1635		NAS# 0819G 48hr - 0 mg/L Lindane OLD	1		X			
	11-11-06	1600		NAS# 0820G 48hr - 8.0 mg/L Lindane NEW	1		X			
	11-11-06	1600		NAS# 0821G 48hr - 0.8 mg/L Lindane NEW	1		X			
	11-11-06	1600		NAS# 0822G 48hr - 0.08 mg/L Lindane NEW	1		X			
	11-11-06	1600		NAS# 0823G 48hr - 0.008 mg/L Lindane NEW	1		X			
	11-11-06	1600		NAS# 0824G 48hr - 0 mg/L Lindane NEW	1		X			
Signature						Company	Date	Time	Cooler Custody Seal	
Relinquished by <i>Julie Fiore</i>		Print Name Julie Fiore		NAS			11-13-06	10:00	Present / Not Present Intact / Not Intact	
Received by									Internal Cooler Temperature Upon Lab Receipt (°C)	
Relinquished by										
Received by										
Relinquished by										
Received by laboratory										

# CHAIN OF CUSTODY RECORD

**Northwestern Aquatic Sciences**  
 3814 Yaquina Bay Rd., P.O. Box 1437, Newport, OR 97365  
 Tel: 541-265-7225, Fax: 541-265-2799, www.nwaquatic.com



Client Name Windward Environmental				Project No. 06-28-04-45		Shipping Information		Testing Required				Comments
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119				Phone No. 206-577-1287		Carrier: UPS Airbill No. 12849 109 61 1003 256 U		Copper	Lindane	Pentachlorophenol	Aniline	
Lab Sample No.	Date Sampled	Time Sampled	Sampled by	Sample Description	Number of Containers							
	11-11-06	1645	G.A. Buhler	NAS# 0825G 48-hr - 1000 mg/L Aniline OLD	1						X	
	11-11-06	1645		NAS# 0826G 48-hr - 100 mg/L Aniline OLD	1						X	
	11-11-06	1645		NAS# 0827G 48-hr - 10 mg/L Aniline OLD	1						X	
	11-11-06	1645		NAS# 0828G 48-hr - 1.0 mg/L Aniline OLD	1						X	
	11-11-06	1645		NAS# 0829G 48-hr - 0 mg/L Aniline OLD	1						X	
	11-11-06	1610		NAS# 0830G 48-hr - 1000 mg/L Aniline NEW	1						X	
	11-11-06	1610		NAS# 0831G 48-hr - 100 mg/L Aniline NEW	1						X	
	11-11-06	1610		NAS# 0832G 48-hr - 10 mg/L Aniline NEW	1						X	
	11-11-06	1610		NAS# 0833G 48-hr - 1.0 mg/L Aniline NEW	1						X	
	11-11-06	1610		NAS# 0834G 48-hr - 0 mg/L Aniline NEW	1						X	
Signature				Print Name		Company		Date		Time		Cooler Custody Seal
Relinquished by <i>Julie Fine</i>				Julie Fine		NAS		11-13-06		1000		Present / Not Present Intact / Not Intact
Received by												
Relinquished by												Internal Cooler Temperature Upon Lab Receipt (°C)
Received by												
Relinquished by												
Received by laboratory												



# CHAIN OF CUSTODY RECORD

## Northwestern Aquatic Sciences

3814 Yaquina Bay Rd., P.O. Box 1437, Newport, OR 97365  
Tel: 541-265-7225, Fax: 541-265-2799, www.nwaquatic.com



Client Name Windward Environmental			Project No. 06-28-04-45		Shipping Information		Testing Required				Comments	
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119			Phone No. 206-577-1287		Carrier: UPS Airbill No. 1Z84149 CI 1503 204 Z		Copper	Lindane	Pentachlorophenol	Aniline		
Lab Sample No.	Date Sampled	Time Sampled	Report Attention Helle Anderson	Sampled by G.A. Buhler	Sample Description	Number of Containers						
	11-13-06	1620			NAS# 0835G 96hr - 1.0 mg/L Cu	1	X					
	11-13-06	1620			NAS# 0836G 96hr - 0.1 mg/L Cu	1	X					
	11-13-06	1620			NAS# 0837G 96hr - 0.01 mg/L Cu	1	X					
	11-13-06	1620			NAS# 0838G 96hr - 0.001 mg/L Cu	1	X					
	11-13-06	1620			NAS# 0839G 96hr - 0 mg/L Cu	1	X					
	11-13-06	1720			NAS# 0850G 96hr - 1000 mg/L Aniline	1				X		
	11-13-06	1720			NAS# 0851G 96hr - 100 mg/L Aniline	1				X		
	11-13-06	1720			NAS# 0852G 96hr - 10 mg/L Aniline	1				X		
	11-13-06	1720			NAS# 0853G 96hr - 1.0 mg/L Aniline	1				X		
	11-13-06	1720			NAS# 0854G 96hr - 0 mg/L Aniline	1				X		
Relinquished by <i>Julie Fiore</i>			Print Name Julie Fiore			Company NAS		Date 11-14-06		Time 1030		Cooler Custody Seal Present / Not Present Intact / Not Intact
Received by												
Relinquished by												Internal Cooler Temperature Upon Lab Receipt (°C)
Received by												
Relinquished by												
Received by laboratory												



Client Name Windward Environmental			Project No. 06-28-04-45		Shipping Information				Testing Required				Comments
Address 200 West Mercer St., Suite 401 City, State, Zip code Seattle, WA 98119			Phone No. 206-577-1287		Carrier: UPS		Airbill No. 12844167 0110032624		Copper	Lindane	Pentachlorophenol	Aniline	
Lab Sample No.	Date Sampled	Time Sampled	Sampled by G.A. Buhler		Sample Description		Number of Containers						
	11-13-06	1650	NAS# 0840G		96hr - 4.0 mg/L Penta		1				X		
	11-13-06	1650	NAS# 0841G		96hr - 0.4 mg/L Penta		1				X		
	11-13-06	1650	NAS# 0842G		96hr - 0.04 mg/L Penta		1				X		
	11-13-06	1650	NAS# 0843G		96hr - 0.004 mg/L Penta		1				X		
	11-13-06	1650	NAS# 0844G		96hr - 0 mg/L Penta		1				X		
	11-13-06	1710	NAS# 0845G		96hr - 8.0 mg/L Lindane		1		X				
	11-13-06	1710	NAS# 0846G		96hr - 0.8 mg/L Lindane		1		X				
	11-13-06	1710	NAS# 0847G		96hr - 0.08 mg/L Lindane		1		X				
	11-13-06	1710	NAS# 0848G		96hr - 0.008 mg/L Lindane		1		X				
	11-13-06	1710	NAS# 0849G		96hr - 0 mg/L Lindane		1		X				
Relinquished by <i>Julie Fione</i>			Print Name <i>Julie Fione</i>		Company <i>NAS</i>		Date <i>11-14-06</i>		Time <i>1030</i>		Cooler Custody Seal Present / Not Present Intact / Not Intact		
Received by											Internal Cooler Temperature Upon Lab Receipt (°C)		
Relinquished by													
Received by													
Relinquished by													
Received by laboratory													

**Northwestern Aquatic Sciences**

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Northwestern Aquatic Sciences

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# Northwestern Aquatic Sciences

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	Date	Temp	pH	DO	Cond	Hard	Alk	NH3	comments
<b>Siletz River Water</b>	10/17/2006	13.6	5.3	8.2	62	26	20		rec'ing data
	10/17/2006					26			
	10/18/2006	12.4	6.0	9.6	95	26	20		rec'ing data
	10/23/2006	11.5	6.8	8.4	75	26	20		rec'ing data
	10/24/2006	10.6	6.0	8.8	150	51	90		rec'ing data
<b>Siletz River Water</b>	<b>Mean</b>	12.0	6.0	8.8	96	31	38	---	
	<b>SD</b>	1.3	0.6	0.6	39	11	35	---	
	<b>n</b>	4	4	4	4	5	4	---	
	<b>Min</b>	10.6	5.3	8.2	62	26	20	---	
	<b>Max</b>	13.6	6.8	9.6	150	51	90	---	
<b>Lab Holding</b>									
holding for tests 31-35	10/18/2006	12.3	7.4	10.7	135	43	50		
	10/19/2006	12.5	7.1	10.8	133	51	60		
	10/20/2006	12.7	7.5	10.6	120	51	30		
	10/21/2006	12.5	7.5	11.1	130	43	30		
	10/22/2006	12.2	7.1	10.9	125	51	60		
	10/23/2006	12.6	6.9	10.8	120	51	30		
	10/24/2006	12.3	7.4	10.8	130	51	50		
	10/25/2006	12.4	6.9	10.8	130	43	30	<0.1	
	10/26/2006	12.6	7.4	10.6	130	43	50	<0.1	
	10/27/2006	12.4	7.0	11.2	130	43	50	<0.1	
	10/28/2006	12.4	7.1	10.8	130	43	40	<0.1	
	10/29/2006	12.9	8.1	10.8	135	51	50	<0.1	
	10/30/2006	12.7	8.0	10.4	130	43	50	<0.1	
	10/31/2006	12.8	7.8	10.2	130	43	40	<0.1	
	11/1/2006	12.6	7.9	10.3	135	43	40	<0.1	
	11/2/2006	12.1	8.2	10.3	130	51	50	<0.1	
	11/3/2006	11.8	7.9	10.8	130	51	40	<0.1	
	11/4/2006	11.2	8.0	11.6	130	51	40	<0.1	
	11/5/2006	11.6	7.9	11.2	135	51	50	<0.1	
	11/6/2006	13.2	7.9	13.0	119	51	30	<0.1	
	11/7/2006	11.9	7.7	11.4	130	51	50	<0.1	
	11/8/2006	11.5	8.0	11.2	125	51	50	<0.1	
	11/9/2006	11.8	8.0	11.3	125	51	40	<0.1	tests 31 - 34 began 11/9/06
holding for test 35	11/10/2006	11.7	7.9	11.2	115	43	50	<0.1	
continues	11/11/2006	11.2	7.7	11.1	120	51	40	<0.1	
	11/12/2006	11.3	7.8	11.0	130	51	40	<0.1	
	11/13/2006	11.4	7.6	11.0	130	51	40	<0.1	

	11/14/2006	11.6	7.5	10.9	125	51	40	<0.1	
	11/15/2006	11.8	7.6	10.9	132	51	40	<0.1	
	11/16/2006	11.4	7.4	11.4	130	43	50	<0.1	test 35 began 11/16/06
Interim holding	11/17/2006	11.6	7.6	11.3	117	51	40	<0.1	
prior to acclimation	11/18/2006	11.8	7.4	11.2	120	51	40	<0.1	
for temperature	11/20/2006	11.9	7.3	11.4	110	51	40	<0.1	
experiments	11/21/2006							<0.1	flow off; all tanks fed
	11/22/2006	11.4	7.2	11.2	125	51	50	<0.1	
temperature	11/24/2006	11.6	7.4	11.6	120	51	40	<0.1	
acclimation to 12C	11/25/2006	12.0	7.6	11.3	135	60	50	0.1	
for test #36	11/26/2006	11.9	7.6	11.2	140	60	50	<0.1	
	11/27/2006	11.6	7.3	11.2	140	51	30	0.1	
	11/28/2006	11.6	7.5	11.2	150	60	50	0.4	
	11/29/2006	11.3	7.4	11.2	140	51	50	0.3	
	11/30/2006	11.7	7.5	11.0	135	60	40	0.2	
	12/1/2006	11.8	7.4	11.4	130	60	40	<0.1	test 36 (12C & 17C) began 12/1/06
temperature	12/2/2006	11.9	7.3	11.2	130	51	40	0.3	
acclimation to 12C	12/3/2006	11.8	7.0	10.4	145	51	30	0.4	
for test #37	12/4/2006	11.4	7.3	10.6	140	60	40	0.2	
	12/5/2006	11.0	6.9	11.2	140	51	40	0.3	
	12/6/2006	12.2	7.3	10.7	125	60	40	0.2	
	12/7/2006	12.0	7.4	10.9	135	60	40	0.2	
	12/8/2006	12.2	7.4	11.0	120	51	40	0.3	test 37 (12C & 22C) began 12/8/06
temperature	11/24/2006	12.2	7.2	11.4	125	51	40	<0.1	
acclimation to 17C	11/25/2006	13.5	7.3	10.7	135	60	50	<0.1	
for test #36	11/26/2006	14.6	7.5	10.2	140	60	40	<0.1	
	11/27/2006	15.5	7.3	9.8	145	60	40	<0.1	
	11/28/2006	16.8	7.8	9.6	140	60	50	<0.1	
	11/29/2006	16.8	7.7	9.4	140	51	50	<0.1	
	11/30/2006	17.0	7.5	9.3	140	60	40	<0.1	
	12/1/2006	16.3	7.4	9.4	140	60	40	<0.1	test 36 (12C & 17C) began 12/1/06
temperature	12/1/2006	16.9	7.3	8.8	145	51	30		
acclimation to 22C	12/2/2006	17.9	7.3	8.9	140	51	30	<0.1	
for test #37	12/3/2006	18.5	7.2	8.8	160	51	30	<0.1	
	12/4/2006	19.3	7.2	9.0	155	51	40	<0.1	
	12/5/2006	20.4	7.3	8.7	170	51	40	<0.1	
	12/6/2006	21.6	7.5	8.5	155	51	50	<0.1	
	12/7/2006	21.1	7.4	8.8	150	51	50	<0.1	
	12/8/2006	21.9	7.5	8.8	150	51	40	<0.1	test 37 (12C & 22C) began 12/8/06
		<b>Temp</b>	<b>pH</b>	<b>DO</b>	<b>Cond</b>	<b>Hard</b>	<b>Alk</b>	<b>NH3</b>	
<b>Tests 31 - 34:</b>	<b>Mean</b>	12.3	7.6	10.9	129	48	44	---	

10/18/06-11/9/06	<b>SD</b>	0.5	0.4	0.6	5	4	9	---
	<b>n</b>	23	23	23	23	23	23	16
	<b>Min</b>	11.2	6.9	10.2	119	43	30	<0.1
	<b>Max</b>	13.2	8.2	13.0	135	51	60	<0.1
		<b>Temp</b>	<b>pH</b>	<b>DO</b>	<b>Cond</b>	<b>Hard</b>	<b>Alk</b>	<b>NH3</b>
<b>Test 35:</b>	<b>Mean</b>	12.1	7.6	11.0	128	48	44	---
10/18/06-11/16/06	<b>SD</b>	0.6	0.4	0.5	5	4	9	---
	<b>n</b>	30	30	30	30	30	30	23
	<b>Min</b>	11.2	6.9	10.2	115	43	30	<0.1
	<b>Max</b>	13.2	8.2	13.0	135	51	60	<0.1
		<b>Temp</b>	<b>pH</b>	<b>DO</b>	<b>Cond</b>	<b>Hard</b>	<b>Alk</b>	<b>NH3</b>
<b>Test 36, 12C:</b>	<b>Mean</b>	11.7	7.5	11.3	136	57	44	---
11/24/06-12/1/06	<b>SD</b>	0.2	0.1	0.2	9	5	7	---
	<b>n</b>	8	8	8	8	8	8	8
	<b>Min</b>	11.3	7.3	11.0	120	51	30	<0.1
	<b>Max</b>	12.0	7.6	11.6	150	60	50	0.4
<b>Test 36, 17C:</b>	<b>Mean</b>	15.3	7.5	10.0	138	58	44	---
11/24/06-12/1/06	<b>SD</b>	1.8	0.2	0.7	6	4	5	---
	<b>n</b>	8	8	8	8	8	8	8
	<b>Min</b>	12.2	7.2	9.3	125	51	40	<0.1
	<b>Max</b>	17.0	7.8	11.4	145	60	50	<0.1
		<b>Temp</b>	<b>pH</b>	<b>DO</b>	<b>Cond</b>	<b>Hard</b>	<b>Alk</b>	<b>NH3</b>
<b>Test 37, 12C:</b>	<b>Mean</b>	11.8	7.2	10.9	133.6	55	39	---
12/2/06-12/8/06	<b>SD</b>	0.4	0.2	0.3	9.0	5	4	---
	<b>n</b>	7	7	7	7	7	7	7
	<b>Min</b>	11.0	6.9	10.4	120.0	51	30	0.2
	<b>Max</b>	12.2	7.4	11.2	145.0	60	40	0.4
<b>Test 37, 22C:</b>	<b>Mean</b>	19.7	7.3	8.8	153	51	39	---
12/1/06-12/8/06	<b>SD</b>	1.8	0.1	0.1	9	0	8	---
	<b>n</b>	8	8	8	8	8	8	7
	<b>Min</b>	16.9	7.2	8.5	140	51	30	<0.1
	<b>Max</b>	21.9	7.5	9.0	170	51	50	<0.1



<b>Aniline Test 686-31</b>							
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK
1,000	0	12.8	7.6	10.5	120	51	440
100	0	12.8	7.4	10.4			
10	0	12.9	7.4	10.4			
1	0	12.8	7.2	10.5			
0	0	12.8	7.2	10.4	110	51	40
1,000	1	12.4	7.4	10.3			
100	1	12.4	7.4	10.2			
10	1	12.3	7.4	10.4			
1	1	12.4	7.3	10.3			
0	1	12.3	7.2	10.2			
1,000	2	12.6	7.5	10.1	125	51	460
100	2	12.5	7.4	10.6			
10	2	12.4	7.4	10.6			
1	2	12.5	7.3	10.6			
0	2	12.4	7.3	10.6	120	51	40
1,000	3	12.8	7.6	10.4			
100	3	12.8	7.5	10.2			
10	3	12.6	7.4	9.9			
1	3	12.8	7.5	10.1			
0	3	12.9	7.5	10.2			
1,000	4	12.5	7.5	10.2	125	51	440
100	4	12.6	7.3	10.1			
10	4	12.3	7.3	10.3			
1	4	12.5	7.2	10.2			
0	4	12.4	7.2	10.2	120	51	40
<b>Mean</b>		12.6	7.4	10.3	---	---	---
<b>SD</b>		0.2	0.1	0.2	---	---	---
<b>n</b>		25	25	25	6	6	6
<b>Min</b>		12.3	7.2	9.9	110	51	40
<b>Max</b>		12.9	7.6	10.6	125	51	460

<b>Copper Test 686-32</b>							
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK
1.0	0	12.2	6.9	10.8	110	51	40
0.1	0	12.1	7.1	10.8			
0.01	0	12.2	7.1	10.7			
0.001	0	12.1	7.1	10.8			
0	0	12.3	7.1	10.6	110	51	40
1	1	12.2	7.2	10.6			
0.1	1	12.3	7.2	10.4			
0.01	1	12.3	7.2	10.2			
0.001	1	12.4	7.2	10.5			
0	1	12.6	7.2	10.3			
1.0	2	12.2	7.3	10.7	120	51	40
0.1	2	12.3	7.3	10.6			
0.01	2	12.3	7.3	10.6			
0.001	2	12.3	7.3	10.6			
0	2	12.6	7.3	10.4	115	51	40
1.0	3	12.7	7.5	10.4			
0.1	3	12.7	7.6	10.3			
0.01	3	12.8	7.6	10.5			
0.001	3	12.6	7.6	10.4			
0	3	12.8	7.6	10.4			
1.0	4	12.1	7.3	10.5	115	51	40
0.1	4	12.1	7.3	10.3			
0.01	4	12.1	7.2	10.4			
0.001	4	12.1	7.2	10.3			
0	4	12.1	7.2	10.2	110	51	40
<b>Mean</b>		12.3	7.3	10.5	---	---	---
<b>SD</b>		0.2	0.2	0.2	---	---	---
<b>n</b>		25	25	25	6	6	6
<b>Min</b>		12.1	6.9	10.2	110	51	40
<b>Max</b>		12.8	7.6	10.8	120	51	40

Pentachlorophenol		Test 686-33					
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK
4.0	0	12.2	7.2	10.4	115	51	40
0.4	0	12.2	7.1	10.4			
0.004	0	12.2	7.1	10.2			
0.004	0	12.2	7.1	10.4			
0	0	12.3	7.1	10.4	110	51	40
4.0	1	12.2	7.4	10.2			
0.4	1	12.2	7.3	10.4			
0.004	1	12.2	7.3	10.4			
0.004	1	12.2	7.2	10.2			
0	1	12.2	7.2	10.3			
4.0	2	12.2	7.5	10.5	125	51	40
0.4	2	12.2	7.4	10.5			
0.004	2	12.2	7.3	10.4			
0.004	2	12.3	7.3	10.6			
0	2	12.3	7.3	10.5	120	51	40
4.0	3	12.7	7.6	10.3			
0.4	3	12.7	7.6	10.4			
0.004	3	12.7	7.6	10.2			
0.004	3	12.8	7.6	10.3			
0	3	12.8	7.5	10.2			
4.0	4	12.1	7.3	10.6	115	51	40
0.4	4	12.1	7.3	10.6			
0.004	4	12.1	7.3	10.5			
0.004	4	12.1	7.2	10.4			
0	4	12.1	7.2	10.4	115	51	40
<b>Mean</b>		12.3	7.3	10.4	---	---	---
<b>SD</b>		0.2	0.2	0.1	---	---	---
<b>n</b>		25	25	25	6	6	6
<b>Min</b>		12.1	7.1	10.2	110	51	40
<b>Max</b>		12.8	7.6	10.6	125	51	40

<b>Lindane</b>		<b>Test 686-34</b>						
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK	
8.0	0	12.2	7.3	10.4	115	51	40	
0.8	0	12.2	7.3	10.2				
0.08	0	12.3	7.2	10.2				
0.008	0	12.1	7.2	10.4				
0	0	12.2	7.2	10.2	115	51	40	
8.0	1	12.1	7.5	10.1				
0.8	1	12.1	7.4	10.2				
0.08	1	12.2	7.3	10.5				
0.008	1	12.2	7.3	10.2				
0	1	12.1	7.3	10.4				
8.0	2	12.2	7.5	10.4	120	51	40	
0.8	2	12.2	7.4	10.5				
0.08	2	12.2	7.4	10.4				
0.008	2	12.1	7.4	10.8				
0	2	12.2	7.3	10.6	120	51	40	
8.0	3	12.7	7.6	10.4				
0.8	3	12.6	7.6	10.2				
0.08	3	12.8	7.6	10.3				
0.008	3	12.8	7.5	10.3				
0	3	12.6	7.5	10.4				
8.0	4	12.1	7.4	10.3	115	51	40	
0.8	4	12.2	7.3	10.2				
0.08	4	12.2	7.3	10.4				
0.008	4	12.3	7.3	10.3				
0	4	12.1	7.2	10.2	115	51	40	
<b>Mean</b>		12.3	7.4	10.3	---	---	---	
<b>SD</b>		0.2	0.1	0.2	---	---	---	
<b>n</b>		25	25	25	6	6	6	
<b>Min</b>		12.1	7.2	10.1	115	51	40	
<b>Max</b>		12.8	7.6	10.8	120	51	40	

<b>Diazinon Test 686-35</b>							
mg/L	DAY	TEMP	pH	DO	COND	HARD	ALK
40	0	12.2	7.3	10.6	115	51	30
4.0	0	12.1	7.3	10.6			
0.4	0	12.2	7.3	10.5			
0.04	0	12.1	7.3	10.7			
0	0	12.1	7.3	10.6	115	51	30
40	1	11.8	7.1	10.6			
4.0	1	11.8	7.1	10.5			
0.4	1	11.7	7.1	10.5			
0.04	1	11.8	7.1	10.4			
0	1	11.8	7.1	10.5			
40	2	11.9	7.3	10.4	120	51	30
4.0	2	12.0	7.3	10.3			
0.4	2	11.9	7.2	10.5			
0.04	2	11.7	7.2	10.6			
0	2	11.8	7.2	10.6	125	51	30
40	3	11.8	7.3	10.6			
4.0	3	11.7	7.3	10.4			
0.4	3	11.8	7.3	10.3			
0.04	3	11.8	7.3	10.3			
0	3	11.9	7.3	10.2			
40	4	11.9	7.3	10.5	120	51	30
4.0	4	11.8	7.3	10.6			
0.4	4	11.8	7.3	10.5			
0.04	4	11.9	7.3	10.3			
0	4	12	7.3	10.4	120	51	40
<b>Mean</b>		11.9	7.2	10.5	---	---	---
<b>SD</b>		0.1	0.1	0.1	---	---	---
<b>n</b>		25	25	25	6	6	6
<b>Min</b>		11.7	7.1	10.2	115	51	30
<b>Max</b>		12.2	7.3	10.7	125	51	40

Temperature Experiment #1			Test 686-36					
12C	DAY	TEMP	pH	DO	COND	HARD	ALK	
12C	0	12.6	7.3	11	120	51	30	
12C	1	12.2	7.4	11.2	120			
12C	2	12.1	6.9	10.2	125	51	30	
12C	3	12.2	7.4	10.4	120			
12C	4	12.5	6.9	10.6	130	51	30	
Mean		12.3	7.2	10.7	123	51	30	
SD		0.2	0.3	0.4	4	0	0	
n		5	5	5	5	3	3	
Min		12.1	6.9	10.2	120	51	30	
Max		12.6	7.4	11.2	130	51	30	
17C	DAY	TEMP	pH	DO	COND	HARD	ALK	
17C	0	16.5	7.3	9.7	125	51	30	
17C	1	17.0	7.2	9	135			
17C	2	16.5	6.8	9.1	140	51	30	
17C	3	17.3	7.4	8.8	130			
17C	4	17.0	7.0	9.0	140	51	30	
Mean		16.9	7.1	9.1	134	51	30	
SD		0.4	0.2	0.3	7	0	0	
n		5	5	5	5	3	3	
Min		16.5	6.8	8.8	125	51	30	
Max		17.3	7.4	9.7	140	51	30	

Temperature Experiment #2			Test 686-37					
12C	DAY	TEMP	pH	DO	COND	HARD	ALK	
12C	0	11.9	7.4	10.6	115	51	30	
12C	1	12.3	7.0	10.1	120			
12C	2	12.6	7.1	10.2	110	51	30	
12C	3	12.1	7.0	10.9	130			
12C	4	12.2	7.0	10.8	125	51	40	
Mean		12.2	7.1	10.5	120	51	33	
SD		0.3	0.2	0.4	8	0	6	
n		5	5	5	5	3	3	
Min		11.9	7.0	10.1	110	51	30	
Max		12.6	7.4	10.9	130	51	40	
22C	DAY	TEMP	pH	DO	COND	HARD	ALK	
22C	0	21.8	7.3	8.8	140	51	30	
22C	1	23.0	6.9	8.2	140			
22C	2	22.6	7.3	8	140	51	40	
22C	3	21.8	7.2	8.2	160			
22C	4	22.2	7.2	8.3	150	51	40	
Mean		22.3	7.2	8.3	146	51	37	
SD		0.5	0.2	0.3	9	0	6	
n		5	5	5	5	3	3	
Min		21.8	6.9	8.0	140	51	30	
Max		23.0	7.3	8.8	160	51	40	

Test ID	Test No.	Nom. Conc. mg/L	Number Exposed	Number Surviving	% Surv.
Aniline	686-31	1,000	5	0	0
		100	5	5	100
		10	5	5	100
		1	5	5	100
		0	5	5	100
Copper	686-32	1	5	0	0
		0.1	5	2	40
		0.01	5	5	100
		0.001	5	5	100
		0	5	5	100
Penta	686-33	4	5	0	0
		0.4	5	0	0
		0.04	5	5	100
		0.004	5	5	100
		0	5	5	100
Lindane	686-34	8	5	0	0
		0.8	5	5	100
		0.08	5	5	100
		0.008	5	5	100
		0	5	5	100
Diazinon	686-35	40	5	0	0
		4	5	5	100
		0.4	5	5	100
		0.04	5	5	100
		0	5	5	100
17C	686-36	17C	5	5	100
		17C	5	5	100
		17C	5	5	100
		17C	5	5	100
12C	686-36	12C	5	5	100
		12C	5	5	100
		12C	5	5	100
		12C	5	5	100
22C	686-37	22C	5	5	100
		22C	5	4	80
		22C	5	5	100
		22C	5	5	100
12C	686-37	12C	5	5	100
		12C	5	5	100
		12C	5	5	100
		12C	5	5	100

Test ID	Test No.	Length (mm)	Weight (g)		Length (mm)	Weight (g)
Aniline	686-31	72	0.49	Mean	74	0.54
		67	0.38	SD	6	0.15
		71	0.47	n	5	5
		79	0.63	Min	67	0.38
		83	0.75	Max	83	0.75
Copper	686-32	55	0.25	Mean	54	0.26
		51	0.19	SD	3	0.09
		50	0.19	n	5	5
		56	0.24	Min	50	0.19
		58	0.42	Max	58	0.42
Penta	686-33	55	0.25	Mean	57	0.28
		51	0.18	SD	14	0.21
		50	0.15	n	5	5
		49	0.17	Min	49	0.15
		82	0.66	Max	82	0.66
Lindane	686-34	59	0.27	Mean	69	0.43
		58	0.27	SD	12	0.21
		68	0.37	n	5	5
		70	0.43	Min	58	0.27
		88	0.79	Max	88	0.79
Diazinon	686-35	70	0.41	Mean	74	0.52
		90	0.90	SD	9	0.22
		70	0.38	n	5	5
		74	0.53	Min	68	0.38
		68	0.40	Max	90	0.90
17C	686-36	80	0.72	Mean	74	0.59
		71	0.46	SD	7	0.15
		65	0.44	n	5	5
		72	0.55	Min	65	0.44
		82	0.78	Max	82	0.78
12C	686-36	88	1.00	Mean	66	0.55
		72	0.66	SD	15	0.28
		60	0.36	n	5	5
		64	0.42	Min	46	0.33
		46	0.33	Max	88	1.00
22C	686-37	70	0.56	Mean	64	0.44
		58	0.32	SD	7	0.11
		55	0.31	n	5	5
		68	0.48	Min	55	0.31
		70	0.51	Max	70	0.56
12C	686-37	65	0.41	Mean	70	0.48
		62	0.30	SD	7	0.14
		80	0.66	n	5	5
		70	0.48	Min	62	0.30
		71	0.55	Max	80	0.66
	Mean	67	0.45			
	SD	11	0.20			
	n	45	45			
	Min	46	0.15			
	Max	90	1.00			



## **APPENDIX C. TOXICITY TESTING VALIDATION REPORT**

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*Dinnel Marine Resources*

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**QUALITY ASSURANCE EVALUATIONS OF LAMPREY  
AMMOCOETE TOXICITY TESTING FOR  
PORTLAND HARBOR RI/FS: PHASE 1**

**Final Report  
23 March 2007**

**For**

**Windward Environmental LLC  
Seattle, Washington**

**Prepared By**

**Dinnel Marine Resources  
Anacortes, WA**

## 1.0 INTRODUCTION

Northwestern Aquatic Sciences (NAS) has been retained by Windward Environmental LLC to determine the sensitivity of lamprey (*Lampetra* sp.) larvae (ammocoetes) to various chemicals as part of the Portland Harbor RI/FS Round 3 Project. Lamprey tests are being conducted in two phases: Phase 1 explored methods for successful holding in the laboratory, generated range-finding data for five chemicals (aniline, lindane, pentachlorophenol, copper and diazinon), and evaluated ammocoete sensitivity to elevated temperatures (17 and 22 °C). Phase two, to be conducted during the spring/summer of 2007, will determine the toxicity of the same five chemicals (plus naphthalene) using definitive flow-through tests. NAS is a State of Washington accredited laboratory (Lab ID number C1238, expiration: 30 September 2007) and is certified to perform a wide range of bioassay testing of water, effluents and sediments. A copy of NAS' accreditation certificate and Scope of Accreditation appears in Appendix 1. There is no similar certification program in the State of Oregon.

This report summarizes the Quality Assurance/Quality Control (QA/QC) evaluations of the Phase I testing conducted by NAS. The QA steps taken to ensure high quality data and maximum data completeness before, during and after Phase 1 testing are described in this report. Major QA tasks included the following:

- A pre-test review of the laboratory test protocol and Standard Operating Procedures (SOPs) for the lamprey testing
- One audit of tests in progress
- An initial evaluation of all data for completeness, correct data entries, and accurate transcription
- A final QA evaluation of overall data quality and usability (this report)

## 2.0 QUALITY ASSURANCE AUDIT RESULTS

### 2.1 REVIEW OF LABORATORY PROTOCOL AND SOPs

There are no published protocols for conducting toxicity tests with lampreys, other than the ASTM and EPA generic protocols for conducting tests with fish and other aquatic life (ASTM 1996; EPA 2002). For this testing program, general guidance was provided by Windward Environmental (2006) and a draft protocol was written by NAS (Protocol No. NAS-686-Lamprey-rf) and reviewed by Dinnel Marine Resources prior to beginning the Phase 1 chemical range finding and elevated temperature testing. DMR found this draft protocol to be well written and reasonably complete given the lack of previous test experiences with this species.

## **2.2 TEST-IN-PROGRESS AUDIT**

An informal test-in-progress “audit” was conducted by Dr. Paul Dinnel on 11 November 2006 during which time the following four chemicals were being tested: aniline, lindane, pentachlorophenol and copper. All testing procedures appeared to conform with NAS’ draft lamprey protocol and no deviations were noted.

## **2.3 INITIAL DATA EVALUATIONS**

All raw data forms and electronic database files were reviewed for completeness and fidelity of transcription to electronic formats. A 100% check was made of all data entered into NAS’ internal electronic database and checks were made of all Excel spreadsheet calculations and formulae. All errors, omissions, clarifications, or changes needed were documented and communicated to NAS. Only a couple of corrections to the draft data report were needed. A copy of DMR’s comment letter to NAS appears in Appendix 2.

## **2.4 FINAL QA EVALUATION OF OVERALL DATA QUALITY AND USABILITY**

Following corrections to the data report by NAS personnel, a 100% check of the corrections was made on 22 March 2007 to verify each correction. All corrections made by NAS were deemed satisfactory. Following this, an overall evaluation of data completeness and quality was accomplished. DMR’s conclusions regarding data completeness and quality follow below.

### **2.4.1 Chain of Custody and Sample Holding**

All chain of custody protocols were properly observed in transfers of test animals (from Windward Environmental) and toxicant samples for chemical analyses (to Columbia Analytical Services). Only one piece of information was missing on the chain of custody forms: the cooler temperature on receipt of lampreys on 18 October 2006.

### **2.4.2 Ammocoete Holding and Feeding**

Lamprey ammocoetes were successfully held in a sand substrate in laboratory tanks supplied with flowing seawater. NAS followed the methods outlined in their draft protocol for holding and acclimation of the ammocoetes except that the feeding regime was modified based on information supplied by Mr. William Swink, a lamprey expert with the USGS.

### **2.4.3 Toxicity Tests**

Range-finding toxicity tests of the chemicals identified above were tested in a static beaker test system using one replicate of each test concentration and 5 test animals per beaker. The tests appeared to meet all provisions outlined in NAS' draft protocol except for one minor water quality deviation: The dilution water hardness registered 51 mg/liter as  $\text{CaCO}_3$  in all batches of test water. This was very slightly above the water hardness limit of 50 mg/liter specified in the draft Field Sampling Plan (Windward 2006). This slight deviation should not have significantly affected the results of the toxicity tests. Loading rates ranged from 0.46 to 0.96 g of fish per liter of test water. These loading rates were all below the draft protocol specified 1.1 g/liter limit (based on EPA recommendations). Control survival in all tests was 100%. All toxicity tests were effective in achieving total mortality in the highest test concentrations and no mortality in the lowest test concentrations, thereby identifying appropriate test concentrations to be used in Phase 2 definitive testing of these same chemicals. The results of the toxicity tests will need to be paired with the chemical analyses conducted by Columbia Analytical Services to derive the actual chemical effects levels.

One chemical (naphthalene) was eliminated from the list of chemicals to be tested during Phase 1 when NAS had difficulty maintaining the concentration of this volatile chemical in the test beakers. All naphthalene testing will be conducted during Phase 2 using a flow through test system. In addition, two temperature stress tests, one at 17 and the other at 22 °C, were added to the test schedule for Phase 1 (see below).

### **2.4.4 Temperature Tests**

Two temperature tests assessed possible stress to lamprey ammocetes, the first at 17 °C and the second at 22 °C. Each temperature was paired with a temperature of 12 °C, which acted as the control. Ammocetes were acclimated to their respective test temperatures at the rate of about 0.5 to 1 °C per day prior to testing. Ammocetes were tested in a static beaker test system using one replicate for each temperature and 5 test animals per beaker. The tests appeared to meet all provisions outlined in NAS' draft protocol except for one minor water quality deviation: The dilution water hardness registered 51 mg/liter as  $\text{CaCO}_3$  in all batches of test water. This was very slightly above the water hardness limit of 50 mg/liter specified in the draft Field Sampling Plan (Windward 2006). This slight deviation should not have significantly affected the results of the temperature tests. Loading rates ranged from 0.79 to 1.05 g of fish per liter of test water. These loading rates were all below the draft protocol specified 1.1 g/liter limit (based on EPA recommendations). Control survival (12 °C) in all tests was 100% and survival in the elevated temperature treatments was 100% (17 °C) and 95% (22 °C).

### **2.4.5 Conclusions**

NAS appears to have successfully completed Phase 1 testing. This phase of testing has validated methods for pre-test holding, acclimation and feeding of ammocetes and identified appropriate concentrations for definitive tests of the five chemicals to be tested in Phase 2. The two temperature tests were also successfully completed and showed that ammocetes are probably not unduly stressed at 17 °C. However, slight mortality (5%) at 22 °C indicates the possibility that ammocetes might be nearing their upper limit for temperature stress, although the mortality of just 1 of the 20 fish tested at this temperature could have easily been due to another factor. Should it be anticipated that future toxicity tests might be run in 22 °C test water, consideration should be given to refining the upper temperature stress limit by running an additional test with temperatures in the range of 20 to 30°C.

### **3.0 REFERENCES**

- ASTM (American Society for Testing and Materials). 1996. Standard guide for conducting acute toxicity tests on test materials with fishes, macroinvertebrates, and amphibians. E729-96. American Society for Testing and Materials, Philadelphia, PA.
- EPA (U.S. Environmental Protection Agency). 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms (Fifth Edition). EPA-821-R-02-012. Office of Water, U.S. EPA, Washington, D.C.
- Windward Environmental. 2006. Portland Harbor RI/FS, Round 3: Lamprey ammocoete toxicity testing field sampling plan (draft). Prepared for the Lower Willamette Group by Windward Environmental LLC, Seattle, WA. 20 pp.

## **Appendix 1**

### **Northwestern Aquatic Sciences' State of Washington Accreditation Certificate and Scope of Accreditation**



## **Appendix 2**

### **Comments by Dinnel Marine Resources to Northwestern Aquatic Sciences Following DMR's QA Review of the Draft Toxicity Test Report**

# **DMR**

---

Dinnel Marine Resources  
1519 13<sup>th</sup> St.  
Anacortes, WA 98221

360-299-8468

16 March 2007

Ms. Michele Redmond  
Northwestern Aquatic Sciences  
PO Box 1437  
Newport, OR 97365

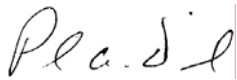
Dear Michele:

I have completed my audit of your draft Phase 1 Portland Harbor Lamprey Ammocoete testing program. As usual, your draft data report is in excellent shape, with just a few minor items needing further attention.

1. Appendix II, page 3 of 73: The last temperature entry (for 12-8-06) appears to be 12.2 on my photocopy, but is recorded as 11.2 in the Excel database (page 49 of 73). Please review.
2. Test Data Analysis Records appendix, page 57 of 73: The two samples at the bottom of the page (22C and 12C) show 5 replicates, whereas only 4 replicates were tested (?).
3. Should you desire "true perfection" in your final report, I noted that on the 5<sup>th</sup> line under "Test Organisms" (page 2 of 7 of the main report), the word "measure" should be "measured". Nit picking it is!

Should you have any questions, please call me at 360-299-8468 or contact me via e-mail at (b) (6). Thank you and your staff for your excellent work.

Sincerely,



Paul Dinnel, Project QA Monitor

# The State of Department



# Washington of Ecology

This is to certify that

## Northwestern Aquatic Sciences Newport, OR

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective October 1, 2006, and shall expire September 30, 2007.

Witnessed under my hand on August 21, 2006.

Stewart M. Lombard

Lab Accreditation Unit Supervisor

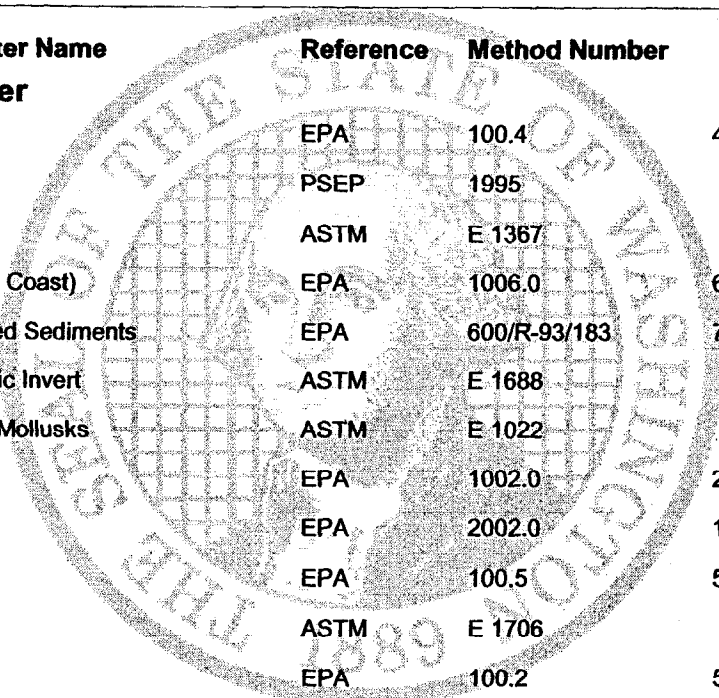
Laboratory ID  
**C1238**

## Scope of Accreditation

### Northwestern Aquatic Sciences

Newport, OR

is accredited by the State of Washington Department of Ecology to perform analyses for the parameters listed below using the analytical methods indicated. This Scope of Accreditation may apply to any of the following matrix types: non-potable water, drinking water, solid and chemical materials, and air and emissions. Accreditation for all parameters is final unless indicated otherwise in a note. Accreditation is for the latest version of a method unless otherwise specified in a note. EPA refers to the U.S. Environmental Protection Agency. SM refers to American Public Health Association's publication, Standard Methods for the Examination of Water and Wastewater, 18th, 19th or 20th Edition, unless otherwise noted. ASTM stands for the American Society for Testing and Materials. PSEP stands for Puget Sound Estuary Program. Other references are detailed in the notes section.



Matrix Type/Parameter Name	Reference	Method Number	Notes
<b>Non-potable Water</b>			
Ampelisca abdita	EPA	100.4	4
Ampelisca abdita	PSEP	1995	
Ampelisca abdita	ASTM	E 1367	
Atherinops affinis (West Coast)	EPA	1006.0	6,8
Bioaccumulation, Bedded Sediments	EPA	600/R-93/183	7
Bioaccumulation, Benthic Invert	ASTM	E 1688	
Bioconcentration, Fish, Mollusks	ASTM	E 1022	
Ceriodaphnia dubia	EPA	1002.0	2,8
Ceriodaphnia dubia	EPA	2002.0	1,8
Chironomus tentans	EPA	100.5	5
Chironomus tentans	ASTM	E 1706	
Chironomus tentans	EPA	100.2	5
Corbicula fluminea	ASTM	E 1688	
Crassostrea gigas	PSEP	1995	
Crassostrea gigas (West Coast)	EPA	1005.0	6,8
Cyprinodon variegatus	EPA	1004.0	3,8
Cyprinodon variegatus	EPA	2004.0	1,8
Dangerous Waste Static Salmonid	WDOE	80-12 Part A	
Daphnia magna	EPA	2021.0	1,8

Matrix Type/Parameter Name	Reference	Method Number	Notes
<i>Daphnia pulex</i>	EPA	2021.0	1,8
<i>Dendraster excentricus</i>	ASTM	E 1563	
<i>Dendraster excentricus</i>	PSEP	1995	
<i>Dendraster excentricus</i> (West Coast)	EPA	1008.0	6,8
<i>Eohaustorius estuarius</i>	ASTM	E 1367	
<i>Eohaustorius estuarius</i>	PSEP	1995	
<i>Eohaustorius estuarius</i>	EPA	100.4	4
<i>Holmesimysis costata</i>	EPA	821-R-02-012	1,8
<i>Holmesimysis costata</i> (West Coast)	EPA	1007.0	6,8
<i>Hyalella azteca</i>	EPA	100.4	5
<i>Hyalella azteca</i>	EPA	100.1	5
<i>Hyalella azteca</i>	ASTM	E 1706	
<i>Leptocheirus plumulosus</i>	ASTM	E 1367	
<i>Leptocheirus plumulosus</i>	EPA	100.4	4
<i>Lumbriculus variegatus</i>	EPA	100.3	5
<i>Lumbriculus variegatus</i>	ASTM	E 1688	
<i>Macoma</i> spp.	ASTM	E 1688	
<i>Menidia beryllina</i>	EPA	1006.0	3,8
<i>Menidia</i> spp.	EPA	2006.0	1,8
<i>Mysidopsis bahia</i>	EPA	1007.0	3,8
<i>Mysidopsis bahia</i>	EPA	2007.0	1,8
<i>Mytilus</i> spp.	PSEP	1995	
<i>Mytilus</i> spp. (West Coast)	EPA	1005.0	6,8
<i>Neanthes arenaceodentata</i>	PSEP	1995	
<i>Nereis/Neanthes</i> spp.	ASTM	E 1688	
<i>Oncorhynchus mykiss</i>	EPA	2019.0	1,8
<i>Pimephales promelas</i>	EPA	2000.0	1,8
<i>Pimephales promelas</i> , Chronic	EPA	1000.0	2,8
<i>Rhepoxynius abronius</i>	EPA	100.4	4
<i>Rhepoxynius abronius</i>	PSEP	1995	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Rhepoxynius abronius	ASTM	E 1367	
Salvelinus fontinalis	EPA	2019.0	1,8
Strongylocentrotus purpuratus	ASTM	E 1563	
Strongylocentrotus purpuratus (WC)	EPA	1008.0	6,8
Strongylocentrotus purpuratus (WC)	EPA	600/R-95/136	6,8
Strongylocentrotus spp.	PSEP	1995	

#### Accredited Parameter Note Detail

(1) USEPA. "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms." EPA-821-R-02-012. Fifth Edition. Oct 2002. (2) USEPA. "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms." EPA-821-R-02-013. Fourth Edition. Oct 2002. (3) USEPA. "Short-term Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms." EPA-821-R-02-014. Fourth Edition. Oct 2002. (4) USEPA. "Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods." EPA 600/R/R-94/025. June 1994. (5) USEPA. "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates." EPA 600/R-99/064. Second Edition. March 2000. (6) USEPA. "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms." EPA 600/R-95/136. Third Edition. Aug 1995. (7) USEPA. "Bedded Sediment Bioaccumulation Tests." EPA/600/R-93/183. Sept 1993. (8) Meets requirements of "Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria." Washington Dept. of Ecology, Pub. No. WQ-R-80, Rev. June 2005.



Authentication Signature



Date

Stewart M. Lombard, Lab Accreditation Unit Supervisor

## **APPENDIX D. WATER CHEMISTRY VALIDATION REPORT**

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**EcoChem, INC.**  
Environmental Data Quality

## **DATA QUALITY EVALUATION PORTLAND HARBOR**

### **LAMPREY AMMOCOETE TOXICITY STUDY**

**Aniline - Method SW8270C  
Pentachlorophenol – Method SW8151  
gamma-BHC (Lindane) – Method SW8081A  
Diazinon – Method SW8141A  
Copper – Method E200.8**

#### **Prepared for:**

Integral Consulting  
7900 SE 28<sup>th</sup> Street, Suite 300  
Mercer Island, Washington 98040

Integral Project: B01-01-58C


#### **Prepared by:**

EcoChem, Inc.  
710 Second Avenue, Suite 660  
Seattle, Washington 98104

EcoChem Project: C22110-5

March 5, 2007

**Approved for Release:**



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Eric Strout  
Project Manager/Technical Director  
**EcoChem, Inc.**

# DATA QUALITY EVALUATION

## BASIS OF DATA EVALUATION

The data were validated using guidance and quality control (QC) criteria documented in the analytical methods; *Guidance on Environmental Data Verification and Validation* (EPA 2002c); *Portland Harbor RI/FS, Round 2, Quality Assurance Project Plan* (QAPP) (Integral 2004); *Addendum 7: Round 3 Chemical Analysis of Lamprey Ammocoete Toxicity Test Water* (Integral 2006), and *National Functional Guidelines for Organic and/or Inorganic Data Review* (USEPA 1994, 1999 & 2002).

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. Data validation reports, which discuss individual findings for each quality control element [by sample delivery group (SDG)], are provided in **Appendix B**. Data validation worksheets and communication records are organized by SDG and will be kept on file at EcoChem.

## PROCESS FOR DATA VALIDATION

All electronic data deliverable files (EDD) were verified by comparing 100% of the field sample results and 10% of the QC sample results to the hardcopy data package.

Sixty percent (60%) of the data received a Level III validation, which included evaluation (as appropriate for each method) of:

- Package completeness
- Sample chain-of-custody and sample preservation
- Analytical holding times
- Blank contamination
- Precision (replicate analyses)
- Accuracy (compound recovery)
- Chromatogram review (pesticide, PCB, and fuel fractions)
- Detection limits
- Instrument performance (initial calibration, continuing calibration, tuning, sensitivity and degradation)

All other data packages received full (Level IV) data validation, which includes evaluation of compound identification and quantitation (transcription and calculation checks).

A dual-tier system of primary and secondary reviewers is utilized to ensure technical correctness and QC of the validation process; and all data validation is documented using standardized and controlled validation worksheets and spreadsheets. These worksheets are completed for each SDG, documenting all deficiencies, outliers and subsequent qualifiers.

After qualifiers are entered into the EcoChem database, a second party verifies 100% of the qualifier entry. Interpretive qualifiers are then applied to the field samples and qualified data is exported to the project database (Integral).

## **SUMMARY OF DATA VALIDATION:**

Twenty (20) water samples were analyzed for aniline, pentachlorophenol, gamma-BHC (Lindane), diazinon, and copper. The water samples represented different concentrations of these analytes at different time periods after dosing, as part of the lamprey ammocoete toxicity test study. Columbia Analytical Services (CAS) completed the analyses.

The data for the samples were acceptable. None of the data were qualified for any reason.

The laboratory data were evaluated in terms of completeness, holding times, instrument performance, bias, and precision. The results of the QC procedures used during sample analyses are discussed below.

### **Completeness of Data Set**

Completeness is defined as the total number of usable results (results that were not rejected during data validation) divided by the total results reported by the laboratory. The results reported by the laboratory were 100% complete.

### **Holding Times and Sample Preservation**

All samples were extracted and analyzed within the method specified holding times.

### **Instrument Performance**

#### ***Calibrations***

Initial and continuing calibrations were completed at the proper frequency. All initial and continuing calibrations met all acceptance criteria.

#### ***Endrin/DDT Breakdown***

Breakdown evaluation mixtures were analyzed at the proper frequency to measure percent breakdown. All percent breakdown values met the acceptance criteria.

### **Method Blank Analyses**

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times (5x) the concentration detected in the blank. If a contaminant is detected in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

Gamma-BHC (Lindane) was detected in several method blanks. The concentrations in the associated samples were greater than the action level. No action was necessary. All other method blanks were free of contamination.

## **Accuracy**

### ***Surrogate Compound Recoveries***

The surrogates were either not recovered or the recovery value was outside the control limits in several of the gamma-BCH (Lindane) and diazinon analyses due to the required dilution factors. No action was taken. All other surrogate recovery values were acceptable.

### ***Matrix Spike Recoveries***

Matrix and duplicate matrix spike (MS/MSD) analyses were not performed. Accuracy was assessed using the surrogate compound and laboratory control sample (LCS) analyses.

### ***Laboratory Control Sample Recoveries***

The gamma-BHC (Lindane) recovery was greater than the upper control limit in one LCS analysis. Since the recoveries were acceptable in the associated LCS duplicate (LCSD) analysis and in all other LCS/LSCD sets, no action was taken. The recovery values for all other analytes were acceptable in all other LCS/LCSD sets.

## **Precision**

LCS/LCSD analyses were evaluated for laboratory precision. All relative percent difference (RPD) values were acceptable.

## **Method Detection Limits and Method Reporting Limits**

With the exception of the copper analyses, most of the samples were analyzed at dilution factors ranging from 5x to 50,000x. Detection/reporting limits were adjusted accordingly.

## **Field Quality Control Samples**

No field QC samples were collected for this study.

**DATA VALIDATION REPORT**  
**Portland Harbor RI/FS**  
**Lamprey Toxicity Study**  
**Aniline by EPA Method 8270C**  
**Columbia Analytical Services - Kelso**

This report documents the review of analytical data from the analyses of water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Columbia Analytical Services, Inc., Kelso, Washington.

SDG	No. Samples	Validation Level
K0610008	5 Water	Full
K0610013	10 Water	Summary
K0610065	5 Water	Summary

## **I. DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

## **II. EDD TO HARDCOPY VERIFICATION**

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

## **III. TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

- |                                    |   |
|------------------------------------|---|
| 1 Holding Times and Sample Receipt | 1 Matrix Spikes/Matrix Spike Duplicates           |
| Initial Calibration (ICAL)         | Laboratory Control Samples (LCS/LCSD)             |
| Continuing Calibration (CCAL)      | 1 Reporting Limits (MDL and MRL)                  |
| Laboratory Blanks                  | Compound Identification                           |
| Surrogate Compounds                | 1 Calculation Verification (full validation only) |

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<sup>1</sup> *Quality control results are discussed below, but no data were qualified.*

<sup>2</sup> *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

### **Holding Times and Sample Receipt**

Some coolers were received at temperatures below the recommended range of 4°C ±2°. These temperature outliers did not impact data quality and no qualifiers were required.

## Matrix Spike/Matrix Spike Duplicates

No matrix spike/matrix spike duplicate analyses were performed with these SDG due to limited sample volumes. Accuracy and precision were assessed from the laboratory control sample/laboratory control sample duplicate (LCS/LCSD).

## Reporting Limits (Method Detection Limit and Method Reporting Limit)

The reporting limits were elevated in the following samples due to dilutions:

SDG	Sample ID	Dilution Factor
K00610008	NAS# 0790G Day 0 – 1000 mg/L Aniline	10,000x
	NAS# 0791G Day 0 – 100 mg/L Aniline	1,000x
	NAS# 0792G Day 0 – 10 mg/L Aniline	50x
	NAS #0793G Day 0 – 1.0 mg/L Aniline	5x
K00610013	NAS# 0805G 48-hr – 1000 mg/L Aniline Old	10,000x
	NAS# 0829G 48-hr – 100 mg/L Aniline Old	1,000x
	NAS# 0829G 48-hr – 10 mg/L Aniline Old	100x
	NAS# 0829G 48-hr – 1.0 mg/L Aniline Old	10x
	NAS# 0830G 48-hr – 1000 mg/L Aniline Old	10,000x
	NAS# 0830G 48-hr – 100 mg/L Aniline New	1,000x
	NAS# 0832G 48-hr – 10 mg/L Aniline New	50x
	NAS #0833G 48-hr – 1.0 mg/L Aniline New	10x
K0610065	NAS# 0850G 96 hr-1000 mg/L Aniline	10,000x
	NAS# 0851G 96 hr-100 mg/L Aniline	1,000x
	NAS# 0852G 96 hr-10 mg/L Aniline	100x
	NAS# 0853G 96 hr-1 mg/L Aniline	10x

## Calculation Verification

**SDG K0610008:** Calculation verifications were performed on this SDG. No errors were found.

## IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed an appropriate analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD analyses.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**Portland Harbor RI/FS**  
**Lamprey Toxicity Study**  
**Pentachlorophenol - EPA Method 8151**  
**Columbia Analytical Services - Kelso**

This report documents the review of analytical data from the analyses of water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Columbia Analytical Services, Inc., Kelso, Washington.

SDG	No. Samples	Validation Level
K0610008	5 Water	Full
K0610013	10 Water	Summary
K0610065	5 Water	Summary

## **I. DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

## **II. EDD TO HARDCOPY VERIFICATION**

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

## **III. TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

- |                                    |   |
|------------------------------------|---|
| 1 Holding Times and Sample Receipt | 1 Matrix Spikes/Matrix Spike Duplicates           |
| Initial Calibration (ICAL)         | Laboratory Control Samples (LCS/LCSD)             |
| Continuing Calibration (CCAL)      | 1 Reporting Limits (MDL and MRL)                  |
| Laboratory Blanks                  | Compound Identification                           |
| Surrogate Compounds                | 1 Calculation Verification (full validation only) |

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<sup>1</sup> *Quality control results are discussed below, but no data were qualified.*

<sup>2</sup> *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

### **Holding Times and Sample Receipt**

Some coolers were received at temperatures below the recommended range of 4°C ±2°. These temperature outliers did not impact data quality and no qualifiers were required.

### Matrix Spike/Matrix Spike Duplicates

No matrix spike/matrix spike duplicate analyses were performed due to limited sample volumes. Accuracy and precision were assessed from the laboratory control sample/laboratory control sample duplicate (LCS/LCSD).

### Reporting Limits (Method Detection Limit and Method Reporting Limit)

The reporting limits were elevated in the following samples due to dilutions:

SDG	Sample ID	Dilution Factor
K00610008	NAS# 0780G Day 0 – 4.0 mg/L Penta	50x
	NAS #0781G Day 0 – 0.4 mg/L Penta	20x
K00610013	NAS# 0805G 48-hr – 4.0 mg/L Penta Old	50x
	NAS# 0806G 48-hr – 0.4 mg/L Penta Old	20x
	NAS# 0810G 48-hr – 4.0 mg/L Penta New	50x
	NAS #0811G 48-hr – 0.4 mg/L Penta New	20x
K0610065	NAS# 0840G 96 hr-4.0mg/L Penta	40x
	NAS# 0841G 96 hr-0.4mg/L Penta	5x

### Calculation Verification

**SDG K0610008:** Calculation verifications were performed on this SDG. No calculation errors were found.

## IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed an appropriate analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD analyses.

No data were qualified for any reason.

All data, as reported, are acceptable for use.



**DATA VALIDATION REPORT**  
**Portland Harbor RI/FS**  
**Lamprey Toxicity Study**  
**gamma-BHC (Lindane) - EPA Method 8081A**  
**Columbia Analytical Services - Kelso**

This report documents the review of analytical data from the analyses of water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Columbia Analytical Services, Inc., Kelso, Washington.

SDG	No. Samples	Validation Level
K0610008	5 Water	Full
K0610013	10 Water	Summary
K0610065	5 Water	Summary

## **I. DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

## **II. EDD TO HARDCOPY VERIFICATION**

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

## **III. TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

- |                                    |   |
|------------------------------------|---|
| 1 Holding Times and Sample Receipt | 1 Matrix Spikes/Matrix Spike Duplicates           |
| Instrument Breakdown Check         | 1 Laboratory Control Samples (LCS)                |
| Initial Calibration (ICAL)         | 1 Reporting Limits (MDL and MRL)                  |
| Continuing Calibration (CCAL)      | Compound Identification                           |
| 1 Laboratory Blanks                | 1 Calculation Verification (full validation only) |
| 1 Surrogate Compounds              |   |

---

<sup>1</sup> *Quality control results are discussed below, but no data were qualified.*

<sup>2</sup> *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

### **Holding Times and Sample Receipt**

Some coolers were received at temperatures below the recommended range of 4°C ±2°. These temperature outliers did not impact data quality and no qualifiers were required.

## Laboratory Blanks

Method blanks are used to evaluate all associated samples, including field blanks. Any remaining positive results in the field blanks are used to evaluate all associated samples.

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times the concentration detected in the blank. If a contaminant is detected in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). If the result is also less than the reporting limit, then the result is elevated to the reporting limit. No action is taken if the sample result is greater than the action level, or for non-detected results.

**SDGs K0610008 & K0610013:** A positive value for gamma-BHC (lindane) was reported in the method blank. All sample results were greater than the action level and no qualifiers were required.

**SDG K0610065:** A positive value for gamma-BHC was reported in the method blank. All sample results were greater than the action level and no qualifiers were required.

## Surrogate Compounds

**SDG K0610008:** Surrogates were not recovered or recovered outside the control limits in Samples NAS# 0785G Day0 – 8.0 mg/L Lindane (20,000x) and NAS# 0786G Day 0 – 0.8 mg/L Lindane (2,500x) due to sample dilution. No qualifiers were assigned.

**SDG K0610013:** Surrogates were not recovered in some samples due to sample dilution:

NAS# 0815G 48-hr – 8.0 mg/L Lindane Old (5,000x)  
NAS# 0816G 48-hr – 0.8 mg/L Lindane Old (500x)  
NAS# 0820G 48-hr – 8.0 mg/L Lindane New (50,000x)  
NAS# 0821G 48-hr – 0.8 mg/L Lindane New (5,000x)  
NAS #0822G 48-hr – 0.08 mg/L Lindane New (250x)

No qualifiers were assigned.

**SDG K0610065:** Surrogates were not recovered or recovered outside the control limits due to sample dilutions in Samples NAS# 0845G 96hr – 8.0 mg/L Lindane (50,000x) and NAS# 0846G 96hr – 0.8 mg/L Lindane (5,000x). No qualifiers were assigned.

## Matrix Spike/Matrix Spike Duplicates

No matrix spike/matrix spike duplicate (MS/MSD) analyses were performed with these SDG due to limited sample volumes. Accuracy and precision were assessed from the laboratory control sample/laboratory control sample duplicate (LCS/LCSD).

## Laboratory Control Samples

**SDG K0610065:** The percent recovery (%R) value for gamma-BHC (lindane) in the LCS was greater than the upper control limit of 130%, at 155%. The %R value in the LCSD was acceptable and no qualifiers were assigned.

## Reporting Limits (Method Detection Limit and Method Reporting Limit)

The reporting limits were elevated in the following samples due to dilutions:

SDG	Sample ID	Dilution Factor
K00610008	NAS# 0785G Day 0 – 8.0 mg/L Lindane	20,000x
	NAS# 0786G Day 0 – 0.8 mg/L Lindane	2,500x
	NAS# 0787G Day 0 – 0.08 mg/L Lindane	250x
	NAS# 0788G Day 0– 0.008 mg/L Lindane	50x
	NAS #0789G Day 0 – 0 mg/L Lindane	20x
K00610013	NAS# 0815G 48-hr – 8.0 mg/L Lindane Old	5,000x
	NAS# 0816G 48-hr – 0.8 mg/L Lindane Old	500x
	NAS# 0817G 48-hr – 0.08 mg/L Lindane Old	250x
	NAS# 0818G 48-hr – 0.008 mg/L Lindane Old	50x
	NAS# 0819G 48-hr – 0 mg/L Lindane Old	10x
	NAS# 0820G 48-hr – 8.0 mg/L Lindane New	50,000x
	NAS# 0821G 48-hr – 0.8 mg/L Lindane New	5,000x
	NAS #0822G 48-hr – 0.08 mg/L Lindane New	250x
	NAS #0823G 48-hr – 0.008 mg/L Lindane New	50x
K0610065	NAS# 0845G 96hr 0 – 8.0 mg/L Lindane	50,000x
	NAS# 96hr – 0.8 mg/L Lindane	5,000x
	NAS# 0847G 96hr – 0.08 mg/L Lindane	100x
	NAS# 0848G 96hr– 0.008 mg/L Lindane	100x
	NAS #0849G 96hr – 0 mg/L Lindane	100x

## Calculation Verification

**SDG K0610008:** Calculation verifications were performed on this SDG. No calculation errors were found.

## IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed an appropriate analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD %R values, with the exceptions noted above. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD analyses.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**Portland Harbor RI/FS**  
**Lamprey Toxicity Study**  
**Diazinon - EPA Method 8141A**  
**Columbia Analytical Services - Kelso**

This report documents the review of analytical data from the analyses of water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Columbia Analytical Services, Inc., Kelso, Washington.

SDG	No. Samples	Validation Level
K0610210	5 Water	Summary
K0610229	10 Water	Summary
K0610283	5 Water	Full

## **I. DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

## **II. EDD TO HARDCOPY VERIFICATION**

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy data package. Laboratory QC results were also verified (10%).

## **III. TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

- |                                    |   |
|------------------------------------|---|
| 1 Holding Times and Sample Receipt | 1 Matrix Spikes/Matrix Spike Duplicates           |
| Instrument Breakdown Check         | Laboratory Control Samples (LCS)                  |
| Initial Calibration (ICAL)         | 1 Reporting Limits (MDL and MRL)                  |
| Continuing Calibration (CCAL)      | Compound Identification                           |
| Laboratory Blanks                  | 1 Calculation Verification (full validation only) |
| 1 Surrogate Compounds              |   |

---

<sup>1</sup> *Quality control results are discussed below, but no data were qualified.*

<sup>2</sup> *Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.*

### **Holding Times and Sample Receipt**

**SDG K0610210:** The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received the sample cooler at 9.4°C. This outlier was determined to have no impact on data quality and no qualifiers were assigned.

## Surrogate Compounds

**SDG K0610210:** Surrogates were not recovered in Samples NAS# 0855G Day 0 – 40 mg/L Diazinon (5,000x) and NAS# 0856G Day 0 – 4.0 mg/L Diazinon (500x) due to sample dilution. No qualifiers were assigned.

**SDG K0610229:** Surrogates were not recovered in Samples NAS# 0860G 48-hr – 40 mg/L Diazinon Old (5,000x), NAS# 0861G 48-hr – 4.0 mg/L Diazinon Old (500x), NAS# 0865G 48-hr – 40 mg/L Diazinon New (10,000x), and NAS #0866G 48-hr – 4.0 mg/L Diazinon New (1,000x) due to sample dilution. No qualifiers were assigned.

**SDG K0610283:** Surrogates were not recovered in Samples NAS# 0870G 96-hr-40 mg/L Diazinon (5,000x) and NAS# 0871G 96-hr-4.0 mg/L Diazinon (500x) due to sample dilution. No qualifiers were assigned.

## Matrix Spike/Matrix Spike Duplicates

**SDG K0610210, K0610229, & K0610283:** No matrix spike/matrix spike duplicate (MS/MSD) analyses were performed with these SDG due to limited sample volumes. Accuracy and precision were assessed from the laboratory control sample/laboratory control sample duplicate (LCS/LCSD).

## Reporting Limits (Method Detection Limit and Method Reporting Limit)

The reporting limits were elevated in the following samples due to dilutions:

SDG	Sample ID	Dilution Factor
K00610210	NAS# 0855G Day 0 – 40 mg/L Diazinon	5,000x
	NAS# 0856G Day 0 – 4.0 mg/L Diazinon	500x
	NAS# 0857G Day 0 – 0.4 mg/L Diazinon	50x
	NAS# 0858G Day 0 – 0.04 mg/L Diazinon	10x
K00610229	NAS# 0860G 48-hr – 40 mg/L Diazinon Old	5,000x
	NAS# 0861G 48-hr – 4.0 mg/L Diazinon Old	500x
	NAS# 0862G 48-hr – 0.4 mg/L Diazinon Old	50x
	NAS# 0863G 48-hr – 0.04 mg/L Diazinon Old	10x
	NAS# 0865G 48-hr – 40 mg/L Diazinon New	10,000x
	NAS# 0866G 48-hr – 4.0 mg/L Diazinon New	1,000x
	NAS# 0867G 48-hr – 0.4 mg/L Diazinon New	100x
	NAS# 0868G 48-hr – 0.04 mg/L Diazinon New	10x
K0610065	NAS# 0870G 96-hr – 40 mg/L Diazinon	5,000x
	NAS# 0871G 96-hr – 4.0 mg/L Diazinon	500x
	NAS# 0872G 96-hr – 0.4 mg/L Diazinon	50x
	NAS# 0873G 96-hr – 0.04 mg/L Diazinon	10x

## Calculation Verification

**SDG K0610283:** Calculation verifications were performed on this SDG. No errors were found.

#### **IV. OVERALL ASSESSMENT**

As was determined by this evaluation, the laboratory performed an appropriate analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD percent recovery values, with the exceptions noted above. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**Portland Harbor RI/FS**  
**Lamprey Toxicity Study**  
**Copper - EPA Method 200.8**  
**Columbia Analytical Services - Kelso**

This report documents the review of analytical data from the analyses of water samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Columbia Analytical Services, Inc., Kelso, Washington.

SDG	No. Samples	Validation Level
K0610008	5 Water	Full
K0610013	10 Water	Summary
K0610065	5 Water	Summary

## **I. DATA PACKAGE COMPLETENESS**

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

## **I. EDD TO HARDCOPY VERIFICATION**

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

## **III. TECHNICAL DATA VALIDATION**

The QC requirements that were reviewed are listed below.

- |   |   |
|---|---|
| 1 Holding Times and Sample Preservation | Matrix Spike Samples                              |
| Initial Calibration                     | Laboratory Duplicates                             |
| Calibration Verification                | ICPMS Internal Standards                          |
| CRDL Standards                          | Reporting Limits (MDL and MRL)                    |
| Laboratory Blanks                       | 1 Calculation Verification (Full validation only) |
| Laboratory Control Samples              |   |

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<sup>1</sup> Quality control results are discussed below, but no data were qualified.

<sup>2</sup> Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

### **Holding Times and Sample Preservation**

Some coolers were received at temperatures below the recommended range of 4°C ±2°. These temperature outliers did not impact data quality and no qualifiers were assigned.

## Calculation Verification

**SDG K0610008:** Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

## IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed an appropriate analytical method. Accuracy was acceptable, as demonstrated by the LCS/LCSD and MS percent recovery values. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD and laboratory duplicate analyses.

No data were qualified for any reason.

All data, as reported, are acceptable for use.



## **APPENDIX E. PHOTO DOCUMENTATION**

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**Photo 1: Siletz River 1**



**Photo 2: Siletz River 2**



**Photo 3: Electrofishing**



**Photo 4: Ammocoete caught in net**



**Photo 5: Ammocoetes in catch bucket**





**Photo 6: Ammucoetes transferred to cooler 1**



**Photo 7: Ammocoetes transferred to cooler 2**



**Photo 8: Packing coolers**





**Photo 9: Transport of coolers**



**Photo 10: Temperature room with 14 tanks**



**Photo 11: Ten-gallon tank setup**



Photo 12: Head tank



Photo 13: Holding tank





**Photo 14: Chiller system**